Introduction to the *M*icroscope

Operation and Preventive Maintenance using the Nikon Labophot

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RUNNING TIME: 26:00 minutes

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This program is intended as an introduction to the compound binocular microscope. No prior microscopic experience is required. It is recommended that this videotape be first viewed in it's entirety; then each section can be repeated for practice and review. Videotape counter readings are provided for this purpose. Counter readings are approximate and may vary according to the equipment being used. To begin, zero the meter upon appearance of the Nikon logo. Do not reset counter between sections. Also, it is beneficial for the viewer to have access to a microscope while viewing the videotape.

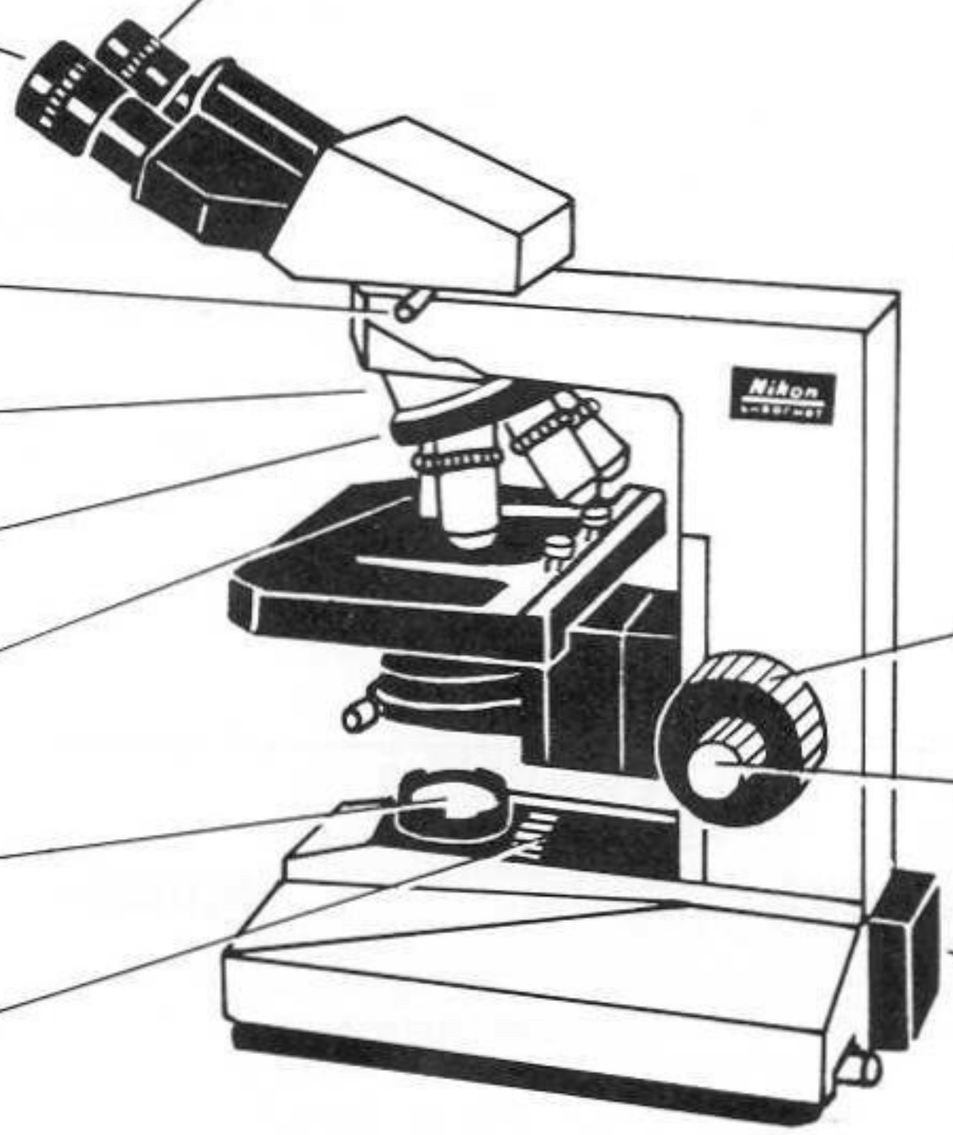
I. Components

Diopter Rings

Adjust for focusing difference between eyes

Rubber Eyeguard

Adjust for comfort



Eyepiece Tube Clamp Screw

Loosen to rotate head

Reverse Facing Nosepiece

For ease in specimen manipulation

Revolving Nosepiece

Use to rotate objectives

Coarse Focus Knob

Brings slide into view

Objectives

Lenses which form primary image of specimen

Fine Focus Knob

Sharpens Image

Field Diaphragm

Aperture diaphragm which restricts area of illumination

Lamp Socket

Holds light source

Field Diaphragm Control Ring

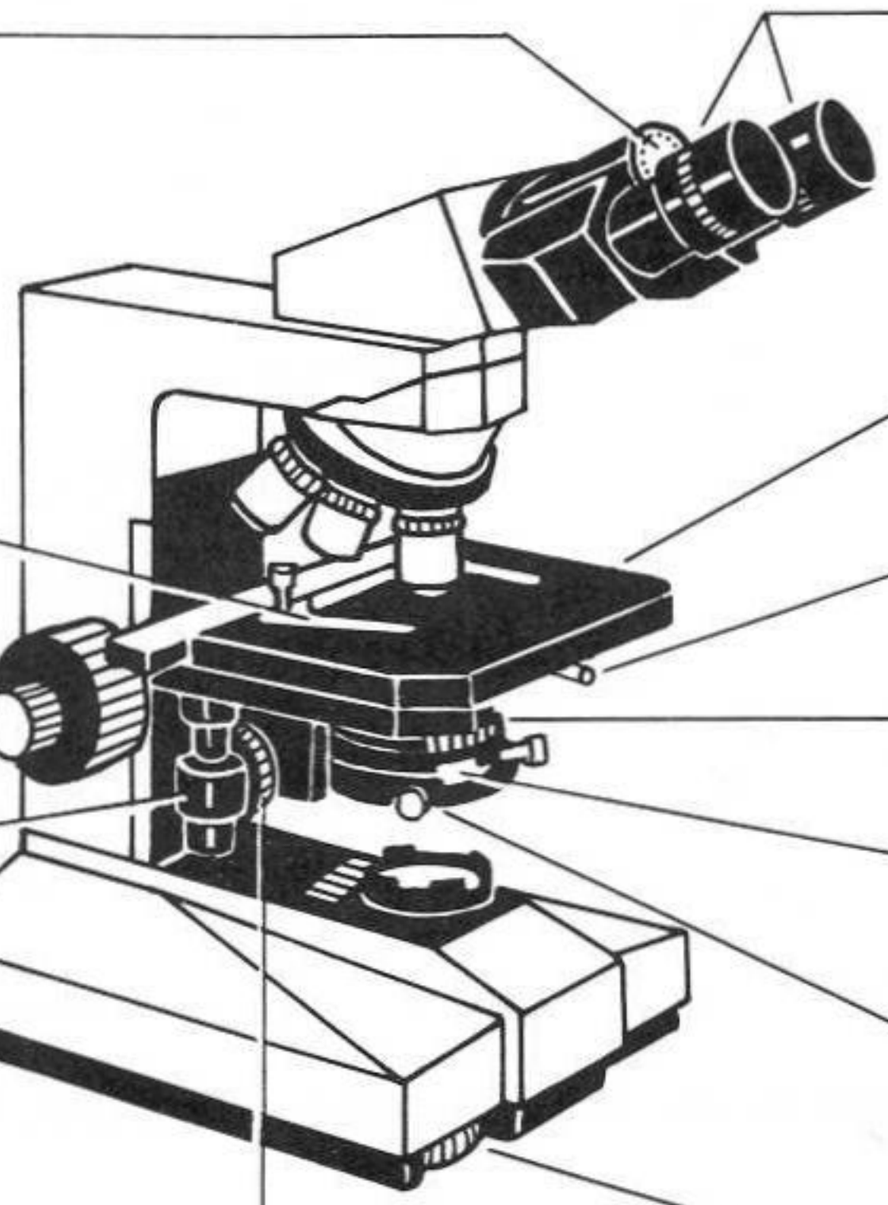
Adjusts size opening of field diaphragm

Interpupillary Distance Scale

Indicates distance between eyes

Eyepieces

10x magnification;
Rotate to adjust for interpupillary distance;
Magnify image (x 10) formed by objective lens



Stage

Holds Specimen

Slide Holder

Holds slide in place

Stage Clamp Screw

Loosen to remove stage

Condenser Control Ring

Adjusts size opening of condenser

X/Y Travel Knobs

Moves slide on stage

Condenser

Aperture diaphragm that controls light

Condenser Centering Screws

Centers the field of view

Brightness Control Dial

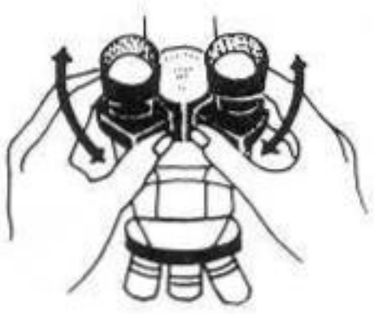
Turns microscope on/off;
Adjusts light intensity

Condenser Focus Knob

Focuses light onto slide

II. Operation

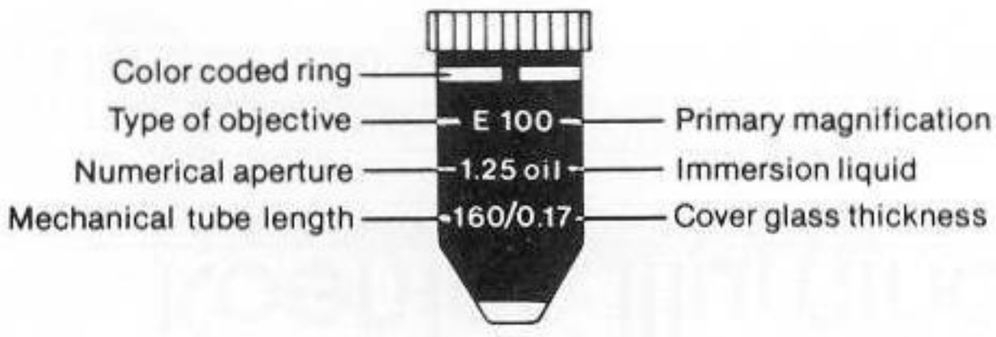
1. With the stage toward you, rotate head into viewing position.
2. Plug power cord into electrical socket.
3. Turn microscope on with brightness control dial.
4. Place slide on stage (cover slip facing up) and secure it with slide holder.
5. Move specimen into light path with X/Y travel knobs.
6. Rotate to 10x objective
7. Adjust light intensity until it is at a comfortable setting for your eyes.



8. Rotate eyepieces to set interpupillary distance so that the right and left images merge into one.
9. Focus on image with coarse and then fine focus knobs.
10. Select a good viewing area using X/Y travel knobs.

11. Hold milled ring on eyepiece stationary.
12. Rotate eyepieces until end surfaces are on white line or "0".
13. Refocus with fine adjustment knob.
14. Check focus on next highest magnification (40x).
15. Return to lowest magnification (4x).
16. Hold milled ring on eyepiece stationary.
17. Rotate eyepieces to adjust for diopter difference (focusing difference between eyes).

Information on Objectives



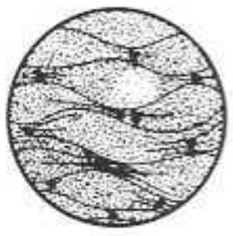
To Calculate the Final Magnification

Magnification of the Eyepiece	×	Magnification of the Objective you are using	=	Final Magnification
10	×	40	=	400

III. Koehler illumination

Koehler illumination is a process which provides optimum contrast and resolution by focusing and centering the light path and spreading the light evenly over the field of view.

1. Rotate to 10x objective.
2. Close condenser aperture diaphragm by turning the condenser control ring to the right.
3. Raise condenser with condenser focus knob.



4. Close the field diaphragm to its smallest opening with the field diaphragm control ring.

5. Focus the field diaphragm image with the condenser focus knob until the edges of the octagonal image are sharp and have a reddish pink tinge.

6. Center the field diaphragm image with the condenser centering screws. This centers the light path onto the specimen plane.
7. Switch to desired objective.

8. Enlarge field diaphragm image toward edge of the field of view with the field diaphragm control ring.
9. Recenter the field diaphragm image.

10. Further enlarge the field diaphragm image until it is just outside the field of view. This provides enough light to fully and evenly cover the observation area.

11. Remove the right eyepiece and look down the eyepiece tube. The circular beam of light is the image of the condenser.

12. Adjust the condenser diaphragm with the condenser diaphragm control ring until the beam fills 3/4 of the tube (1/4 of the area of the tube will be dark and 3/4 will be light). This provides optimum contrast and resolution.
13. Replace eyepiece.
14. Adjust light intensity with the brightness control dial.

IV. Oil immersion

Oil should never come in contact with the dry lenses such as the 4x, 10x or 40x objectives or be placed on the slide until the viewing area has been chosen.

1. Rotate to 10x objective.
2. Select viewing area.
3. Rotate 10x out of light path.
4. Place drop of immersion oil above beam of light.
5. Watching from the side of microscope, rotate to the oil immersion objective. Do not allow dry objectives to pass through the oil.
6. Adjust the fine focus.
7. If necessary, center and focus the field diaphragm image.
8. Enlarge field diaphragm image.
9. Remove eyepiece.
10. Adjust condenser diaphragm to fill 3/4 the tube.
11. Replace eyepiece.
12. Adjust light intensity. More light is required at higher magnifications.
13. Observe specimen.
14. After you are finished, clean lens and slide. Remove excess oil by blotting with clean lens paper. Continue cleaning with 1-3 drops methanol. Start from center of lens and move in a circular motion towards outside of the lens. Gently blot the lens dry. Never rub the lens because of foreign particles possibly being present.

V. Preventive maintenance

To replace bulb:

1. Turn off and unplug microscope prior to replacing bulb. Pull lamp socket out of the microscope base and remove the old bulb from its socket.

2. Do not handle new bulb with fingers. Use the protective packet and place the bulb pins directly into the socket. Insert socket into the base.

To clean optics:

3. Dust eyepieces, condenser, field lens and filters often with a camel's hair brush or bursts of air. Clean the eyepieces and objectives with lens paper only when finger prints or smudges appear or when dusting does not seem to correct a problem.

4. Clean the oil immersion lens at the end of each day's use with lens paper and periodically with methanol or lens cleaning solution.

5. If objectives get immersion oil or other fluids on them clean immediately. First blot the lens with clean lens paper to remove fluid. Dampen lens paper with 1-3 drops of methanol and use the procedure described in the oil immersion section. Finally blot the lens dry.

To inspect objectives:

6. Carefully unscrew the objective from its socket, keeping one hand underneath the objective to prevent it from falling. Remove one eyepiece and invert it; it then becomes a high powered magnifying glass. Aim it toward the lens at a 45 degree angle until the image of the lens is in focus. A clean lens should sparkle.

7. Use xylene to remove stubborn smudges. Moisten a cotton tipped swab in xylene and apply sparingly to the optic in a circular motion. Use extreme caution with xylene because it can soften the lens cement and cause severe damage.

To store microscope:

8. Keep microscope covered or placed in its protective case when not in use.

To carry microscope:

9. Carry the microscope with one hand on the arm and the other supporting the base.

VI. Trouble shooting

Problem	Probable cause	Corrective action
FOCUSING		
Won't focus on 40x or higher magnification	Specimen slide upside down	Turn glass slide over so that the coverslip faces up
Nonparfocal	Set-up procedure not correctly followed	Repeat "Operation" steps 11-17
	Objective has come partially unscrewed	Tighten objective
LIGHTING		
No light	Microscope not plugged in	Plug into outlet
	Brightness control dial turned off	Turn up light intensity
	Objective not clicked into position	Click objective into place
	Condenser image completely off center when field diaphragm is closed down	Adjust image with centering screws
	Bulb burned out	Replace bulb
	Bulb not inserted properly	Insert bulb correctly
	Fuse blown	Replace fuse
	Fuse not inserted properly	Insert fuse correctly
	No power from wall outlet	Test or try different outlet
Insufficient light	Brightness control dial set too low	Increase brightness
	Condenser diaphragm closed	Open condenser diaphragm
	Substage condenser lowered too far (not correctly focused)	Adjust height of substage condenser as per Koehler Method
Flickering	Loose power connection	Plug in microscope or try another wall outlet
	Corrosion on bulb pins	Clean pins on bulb
	Defective bulb socket	Replace socket
	Bulb not inserted properly	Insert bulb correctly
	Situation not covered above	Call for repair
Too bright	Light turned up too high	Adjust brightness
MISCELLANEOUS		
Eyestrain	Illumination of field too intense	Reduce light intensity
	Eyepieces not focused for each eye	Repeat "Operation" steps 11-17
Floating spots	"Debris" in the vitreous humor of the retina; noticeable at high magnifications	Taking a break & resting will often help
Field diaphragm noncenterable	Substage condenser seated improperly in condenser carrier	Loosen condenser clamp screw and reseat condenser
Bubbles or dark wave passes across the field of view when using immersion oil	Air bubbles in oil; contact between oil immersion objective and oil "broken"	Clean slide and/or add more oil

Designed and Developed by:
Cheryl Thayer Tryon
Barbara Smith Michael

Technical Consultants, Nikon Inc.
Mel Brenner
Barbara Loechner

KR-7221.A

MICROSCOPE LABOPHOT-2

REPAIR PARTS LIST

修 理 部 品 表

NIKON CORPORATION

Tokyo, Japan

(90.2.210)H

Ⅱ. 部品表の説明 ---------- Explanation of Parts List

HDA13310 ----- 製品コード ----- Product code No.

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs. per unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
108	2K670-002	Telescope upper cover 望遠鏡上蓋	1	4	
A2	2B500-002	Eyepiece lead screw 目盛接眼	1	4	
AL3A	AL3A	Finder ファインダ	1	4	

部品コード ---------- Parts code No.
展開図の部品につける見出し番号 ---------- Index No. in the Explosion Drawing

Ⅲ. 部品（組品）の注文 ---------- How to order part(s)

部品（組品）は「製品コード」と「部品番号」を併記して注文する。 ---------- Part(s) should be ordered clearly indicating both "Product code No." and "Parts No.."

	製品コード Product code No.	部品番号 Parts No.
例 e.g.	HDA13310	2K670−002
	HDA13310	2B500−002
	HDA13310	AL3A

Ⅳ. 記号の説明 ---------- Explanation of symbols

1. 展開図の中の記号 ---------- Symbols in the Explosion Drawing

Ad ( ) ----- 接着剤 ---------- Adhesive

Lub ( ) ----- 潤滑剤 ---------- Lubricant

5→5-1 ----- 旧品5から、互換性のない新品5-1に変更されたが旧品5の要求もできる ---------- Index No.5 was changed to No.5-1 which is not interchangeable part, but shall be supplied if needed.

5-1 ----- 旧品5は要求できない ---------- Index No.5 was replaced with modified No.5-1 and shall be no longer supplied.

2. 部品表の中の記号 ---------- Symbols in the Parts List

補助番号欄 ---------- Column of Index No.

A ----- 金属部品の組品 ---------- Subassembly, composed of metal elements

L ----- レンズ、プリズムの貼り合わせ組品 ---------- Optical subassembly, cemented each other

AL ----- 金属部品とレンズ、プリズムの組品 ---------- Subassembly, composed of metal and optical elements

-1,-2 ----- 互換性のなくなった部品（組品）の補助番号につける。数字は変更回数 ---------- Appended to the Index No. of new part(s) which is(are) no more interchangeable. The number means the time of modification.

備考欄 ---------- Column of Remarks

TD- ----- 製品技術資料番号 ---------- Reference No. of Technical Data sheets

t ----- 厚さ ---------- Thickness

d ----- 直径 ---------- Diameter

ℓ ----- 長さ ---------- Length

Add. ----- 追加 ---------- Added

Dis. ----- 廃止 ---------- Discontinued

◎,◉ ----- 共通部品 ---------- Common part(s)

3. その他の記号 ---------- Other symbols

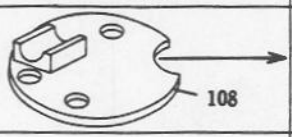
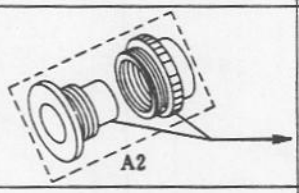
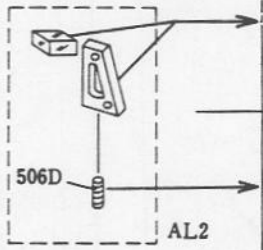
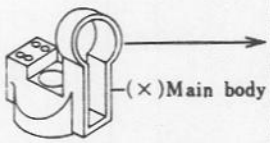
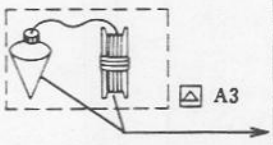
Rev. ----- 改訂 ---------- Revised

★ ----- 変更した箇所につける ---------- To be marked when part is modified.

(3/4)

内容説明　Introduction

Ⅰ．展開図の見方 Explanation of Explosion drawing

分類 Classification		図示例 Sample drawing	注文の対象となる補助番号 Index No. to be used when you order parts	記号 Mark
修理部品扱い regarded as repair parts	点線で囲まれていないもの Part(s), not encircled by a dotted line		AL3A	○
			108	
			L7	
	点線で囲まれていて、且、個々に補助番号がついていないもの Part(s), encircled by a dotted line, but without each Index No.		A2	△
			AL2	
	点線で囲まれていて、且、個々に補助番号がついているもの Part(s), encircled by a dotted line and with each Index No.		506D, AL2 ┐どちらでも注文できる Either Index No.506D, AL2 will be O.K.	○△
	(×) 印がついているもの Part(s), marked (×)		なし（注文できない） Not considered as repair part(s)	×
営業販売品扱い delivered as a product	点線で囲まれていなくて、補助番号に◎印がついているもの Part(s), not encircled by a dotted line but with Index No. marked ◎		32	◎
	点線で囲まれていて、且、個々に補助番号がついていないもの Part(s), encircled by a dotted line, but without each Index No.		A3	△

補助番号：　展開図の中の部品（組品）の見出し番号……AL3A, 108, L7, A2, 506D など

Index No.: Number, used in stead of Part(s) No. for the sake of convenience

(¼)

機械標準品 (Standard mechanical elements)

コード桁数 (Code Fig.) 1 2 3 4 5 6 7 8 9 10 11
部品コード (Code No.) □○－○○○○○－○○

コード桁数(Code Fig.)	1		2	3	4 5	6 7 8	9	10	11	
品名 Classification	種別 Type			ハイフン	呼び径 dia.	長さ Length	材料 mtl.	外装 Coat	予備番 Spare	当リストで用いる名称 Name used in this List
JIS C 十字穴付き小ねじ 1種 Cross recessed screw Type 1	A	なべ	Pan head Machine screw	1						JIS ⊕ なべ小ねじ JIS ⊕ PM1.4×1.4 ①
		さら	Countersunk head Machine screw	2	14	014	F・B・S	A ～ Y		JIS ⊕ さら小ねじ JIS ⊕ CM1.4×1.4 ①
		丸さら	Oval Countersunk head Machine screw	3						JIS ⊕ 丸さら小ねじ JIS ⊕ OCM1.4×1.4 ①
JIS C 十字穴付き小ねじ 3種 Cross recessed screw Type 3	B	なべ	Pan head Machine screw	1						JIS ⊕ なべ小ねじ JIS ⊕ PM2.6×10 ③
		さら	Countersunk head Machine screw	2	26	0100				JIS ⊕ さら小ねじ JIS ⊕ CM2.6×10 ③
		丸さら	Oval Countersunk head Machine screw	3						JIS ⊕ 丸さら小ねじ JIS ⊕ OCM2.6×10 ③
十字穴付き小ねじ Cross recessed screw	C	なべ	Pan head Machine screw	1						⊕ なべ小ねじ ⊕ PM3×0.5×5
		さら	Countersunk head Machine screw	2	30	0500				⊕ さら小ねじ ⊕ CM3×0.5×5
		丸さら	Oval Countersunk head Machine screw	3						⊕ 丸さら小ねじ ⊕ OCM6×60
		トラス	Truss head Machine screw	4	60	0600				⊕ トラス小ねじ ⊕ TM6×60
十字穴付き タッピンねじB型1種 Cross recessed tapping screw Type B-1	D	なべ	Pan head Tapping screw Type B	1						⊕ なべタッピンねじ ⊕ PTB1.4×2.5 ①
		さら	Countersunk head Tapping screw Type B	2	14	0025		A ～ Y		⊕ さらタッピンねじ ⊕ CTB1.4×2.5 ①
		丸さら	Oval Countersunk head Tapping screw Type B	3			F			⊕ 丸さらタッピンねじ ⊕ OCTB1.4×2.5 ①
十字穴付き タッピンねじB型3種 Cross recessed tapping screw Type B-3	E	なべ	Pan head Tapping screw Type B	1						⊕ なべタッピンねじ ⊕ PTB2×10 ③
		さら	Countersunk head Tapping screw Type B	2	20	0100				⊕ さらタッピンねじ ⊕ CTB2×10 ③
		丸さら	Oval Countersunk head Tapping screw Type B	3						⊕ 丸さらタッピンねじ ⊕ OCTB2×10 ③
十字穴付き タッピンねじ 2種 Cross recessed tapping screw Type 2	F	なべ	Pan head Tapping screw	1	26	0400	F・S	A ～ Y		⊕ なべタッピンねじ ⊕ PT2.6×4 ②
		さら	Countersunk head Tapping screw	2						⊕ さらタッピンねじ ⊕ CT2.6×4 ②
		丸さら	Oval Countersunk head Tapping screw	3	60	0500				⊕ 丸さらタッピンねじ ⊕ OCT 6×50 ②
十字穴付き タップタイトねじ B型1種 Cross recessed tapping tight Screw Type B-1	G	なべ	Pan head Tapping Tight screw Type B	1	14	0018	F	A ～ Y		⊕ なべタップタイトねじ ⊕ PTTB1.4×1.8 ①
		さら	Countersunk head Tapping Tight screw Type B	2						⊕ さらタップタイトねじ ⊕ CTTB1.4×1.8 ①
		丸さら	Oval Countersunk head Tapping Tight screw Type B	3	20	0100				⊕ 丸さらタップタイトねじ ⊕ OCTTB1.4×1.8 ①
十字穴付き タップタイトねじ B型3種 Cross recessed tapping tight Screw Type B-3	H	なべ	Pan head Tapping Tight screw Type B	1	14	0018	F	A ～ Y		⊕ なべタップタイトねじ ⊕ PTTB1.4×1.8 ③
		さら	Countersunk head Tapping Tight screw Type B	2						⊕ さらタップタイトねじ ⊕ CTTB1.4×1.8 ③
		丸さら	Oval Countersunk head Tapping Tight screw Type B	3	20	0100				⊕ 丸さらタップタイトねじ ⊕ OCTTB1.4×1.8 ③

コード桁数(Code Fig.)	1			2	3	4	5	6	7	8	9	10	11	
品名 Classification		種別 Type			ハイフン	呼び径 dia.		長さ Length			材料 mtl.	外装 Coat	予備番 Spare	当リストで用いる名称 Name used in this List
すりわり付き止ねじ Slotted set screw	K	丸先	Set screw Round point	1	—	1	0	0	1	2	F	A		止ねじ丸先 SR 1×1.2
		とがり先	Set screw Cone point	2							·	~		止ねじとがり先 SC 1×1.2
		くぼみ先	Set screw Half point	3		6	0	2	0	0	B	Y		止ねじくぼみ先 SH 6×20
六角穴付き止ねじ Hexagon socket set screw	L	丸先	Hexagon Socket head set screw Round point	1	—	3	0	0	3	0	F	A		六角穴付き止ねじ丸先 HSR 3×0.5×3
		とがり先	Hexagon Socket head set screw Cone Point	2								~		六角穴付き止ねじとがり先 HSC 3×0.5×3
		くぼみ先	Hexagon Socket head set screw Half point	3		8	0	3	5	0		Y		六角穴付き止ねじくぼみ先 HSH 3×0.5×3
六角穴付きボルト Hexagon socket bolt	M		Hexagon Socket head Bolt	1	—	0 2	3 4	0 1	0 0	4 0	F	A~Y		六角穴付きボルト HSB 3×0.5×4
平行ピン Straight pin	P		Straight Pin	1	—	1 6	0 0	0 4	3 0	0 0	F	A~Y		平行ピン SP 1×3
テーパピン Taper pin			Taper Pin	2	—	1 4	0 0	0 4	6 0	0 0	F	A~Y		テーパピン TP 1×6
スプリングピン Spring pin		一般用	Spring Pin Normal pressure	3	—	1 4	0 0	0 4	4 0	0 0	S	B·X		スプリングピン SPN1×4
		軽荷重用	Spring Pin Light pressure	4	—	2 4	0 0	0 4	5 0	0 0	S	B·X		スプリングピン SPL2×5

コード桁数(Code Fig.)	1			2	3	4	5	6	7	8	9	10	11	
品名 Classification		種別 Type			ハイフン	呼び径 dia.			空欄 Blank		材料 mtl.	外装 Coat	予備番 Spare	当リストで用いる名称 Name used in this List
六角ナット Hexagon nut	N	1種	Hexagon Nut Type ①	1	—	0	2	0	0	0	F	A		六角ナット HN2①
		3種	Hexagon Nut Type ③	3		2	4	0	0	0	· B	~ Y		六角ナット HN24③
平座金 Plane washer	R	小形丸	Plane Washer Small size	1	—	0	1	4	0	0	F	A		平座金小形丸 PWS 1.4
		みがき丸	Plane Washer Normal size	2		2	4	0	0	0	· B	~ Y		平座金みがき丸 PWN24
ばね座金 Spring washer			Spring Washer	5	—	0 2	2 4	0 0	0 0	0 0	F·P	A~Y		ばね座金 SW2
止め輪 Snap ring	S	E型	E-ring	1	—	0 2	0 4	8 0	0 0	0 0	F·S	A~Y		E型止め輪 E0.8
		G型	G-ring	2	—	0 5	3 0	0 0	0 0	0 0	F	A~Y		G型止め輪 G3
		GS型	GS-ring	3	—	0 2	1 5	5 0	0 0	0 0	F	A~Y		GS型止め輪 GS1.5
鋼球 Steel ball	T	ミリ	Steel ball millimeter size	1	—	0 0	0 3	5 0	0 0	0 0	F·S	X		鋼球 SB0.5
		インチ	Steel ball inch size	2	—	0 1	1 2	5 7	0 0	0 0	F·S	X		鋼球 SB 1/16

機械標準品（Standard mechanical elements）

コード桁数（Code Fig.） 1 2 3 4 5 6 7 8 9 10 11
部品コード（Code No.） □○－○○○○○□□○

コード桁数(Code Fig.)	1			2	3	4	5	6	7	8	9	10	11	
品名 Classification		種別 Type			ハイフン	呼び径 dia.			長さ Length		材料 mtl.	外装 Coat	予備番 Spare	当リストで用いる名称 Name used in this List
ヘリサート Heli-sert	U	ミリ	Heli-sert millimeter size	1	—	0 2	3 4	0 0	1 2	0 0	S	X		ヘリサート H3-1.0
		インチ	Heli-sert inch size	2	—	0	6	3	1 1	0 5	S	X		ヘリサート H 1/4 -1.0

外　装（Coating）

コード9桁 ＼ コード10桁	A	B	C	D	E	F	G	H	R	S	T	X	Y
F 鉄鋼 Ferro-alloy	Ni	Ni-BNi	Ni-Cr	BZn	クロメート	黒色クロメート		Jg	Ni-BNi B-F-B	Ni-BNi B-D-B	Ni-BNi B-G-B	外装なし	メーカー自主処理のもの
B 黄銅 Brass	Ni	BNi	Ni-Cr				DCr		BNi B-F-B	BNi B-D-B	BNi B-G-B		
S ステンレス Stainless-steel		Bst											
P りん青銅 Phosphor-bronze	Ni	BNi	Ni-Cr										

凡例（Explanations）

	名称（Name）	標準部品コード（Code No.）
e.g. 1	⊕TM 3×0.5×8 長さ（Length）mm（ℓ） ピッチ（Pitch）mm 呼び径（Diameter）mm（d） トラス（Truss head Machine screw） 十字穴付き（Cross recessed）	C4－30080BB□ 十字穴付き小ねじ（Cross recessed screw） トラス（Truss head Machine screw） 呼び径（Diameter）3.0mm 長さ（Length）8.0mm 材料・黄銅（Material）（Brass） 外装（Coat）BNi 予備番（Spare）
e.g. 2	JIS⊕OCM 1.4×3 ① 1種（Type 1） 長さ（Length）mm（ℓ） 呼び径（Diameter）mm（d） 丸さら（Oval Countersunk head Machine screw） JISねじ（JIS screw）	A3－14030FC□ 十字穴付き小ねじ1種（Cross recessed Type 1） 丸さら（Oval Countersunk head Machine screw） 呼び径（Diameter）1.4mm 長さ（Length）3.0mm 材料・鉄鋼（Material）（Ferro-alloy） 外装（Coat）Ni-Cr 予備番（Spare）

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— CONTENTS —

§. MBA33510(Microscope LABOPHOT-2)

Illustration (Fig.1～Fig.6) ·····1～6

Parts List ·····7～17

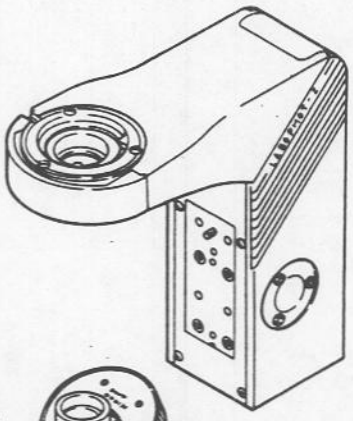


Fig. 2

Fig. 6

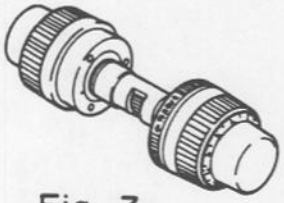


Fig. 3

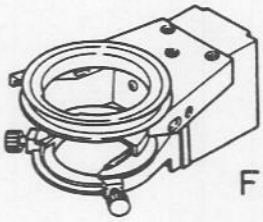


Fig. 4

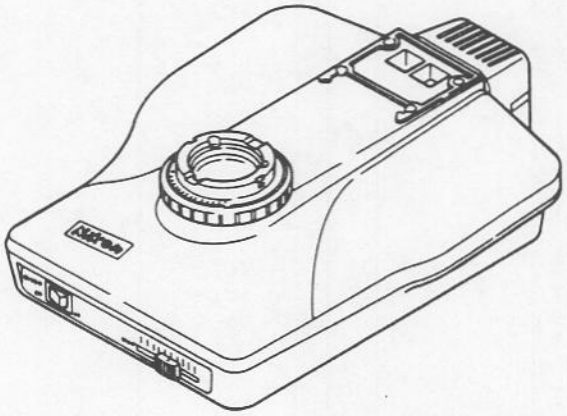
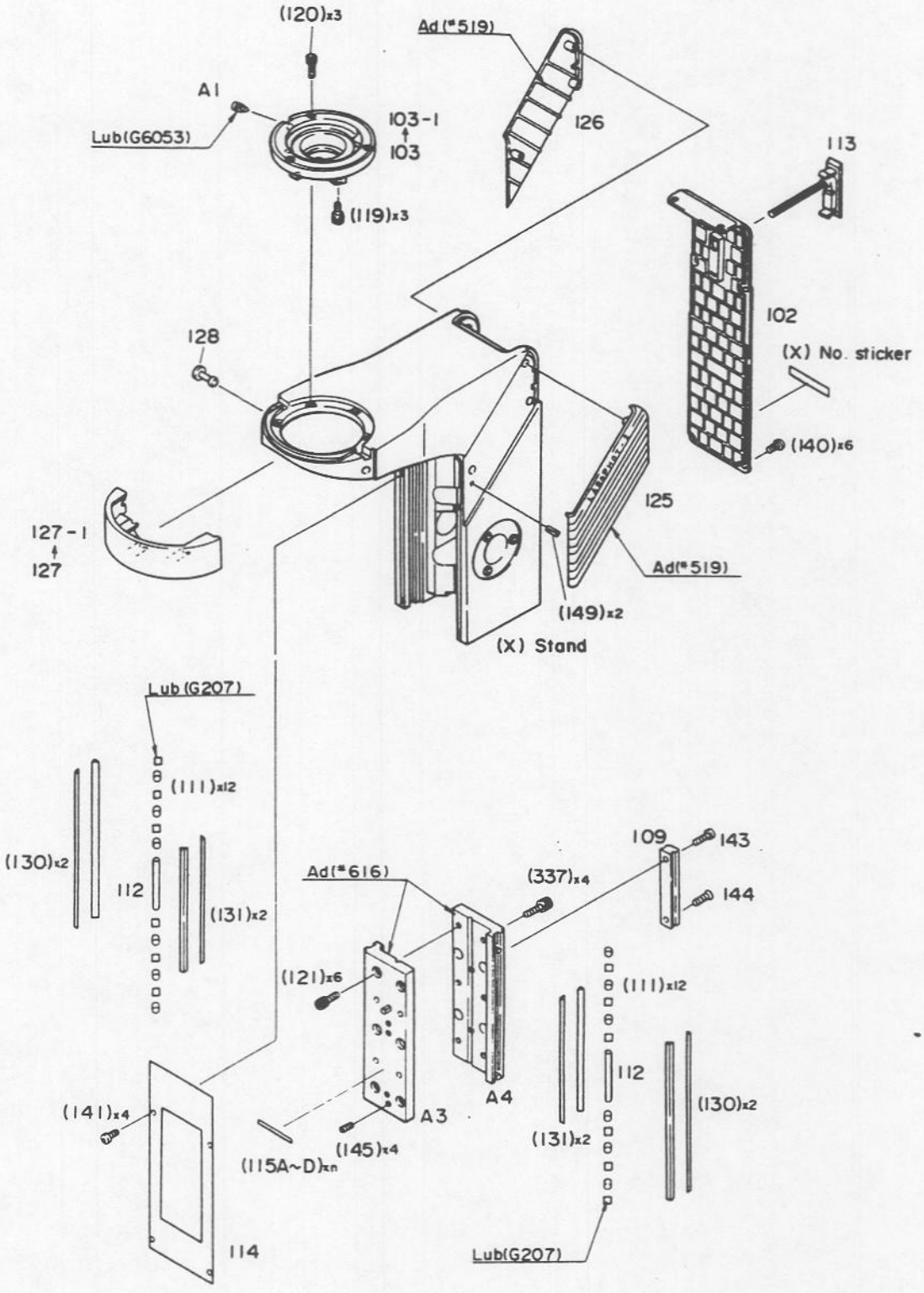


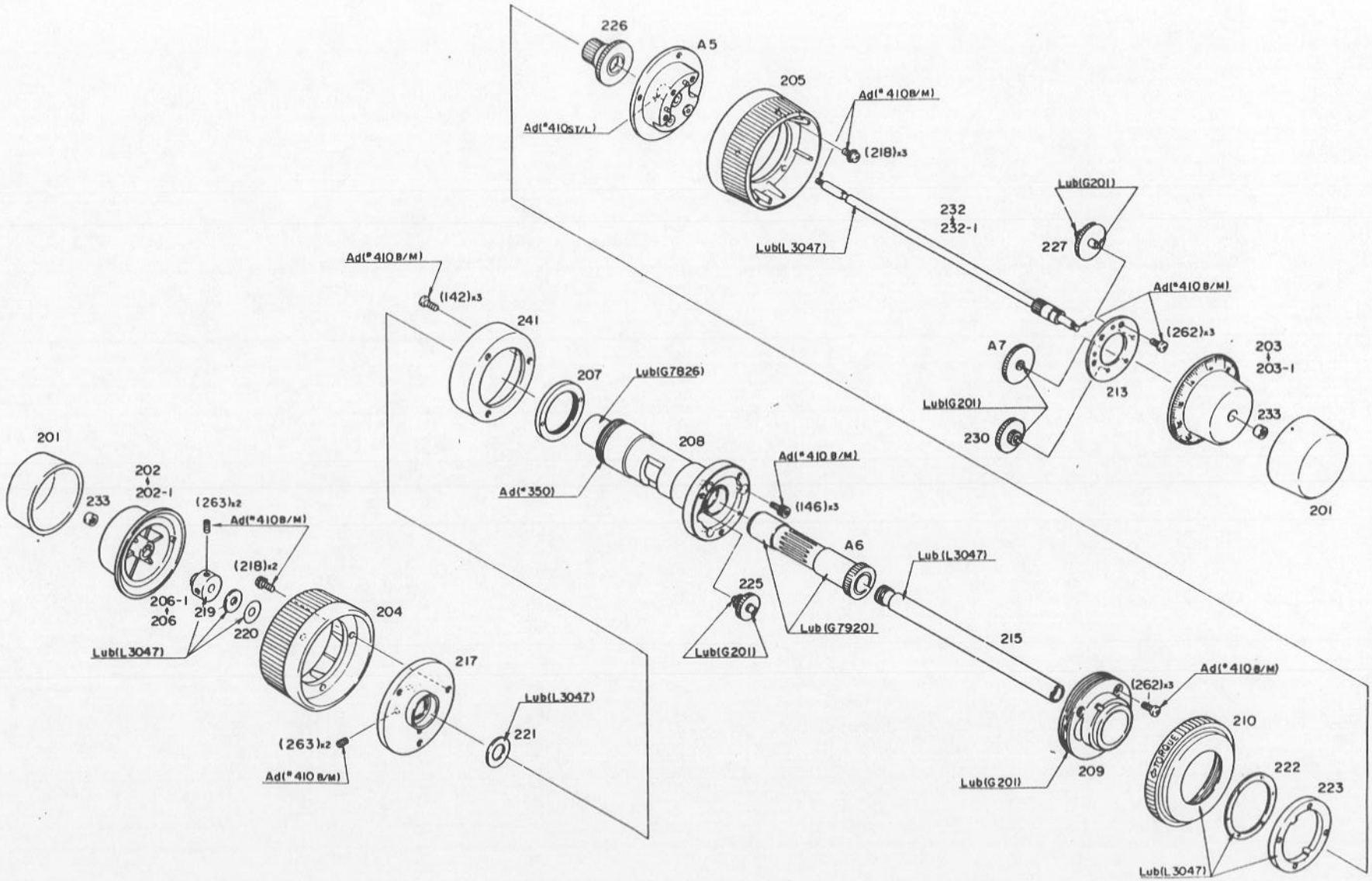
Fig. 5

Fig. 1



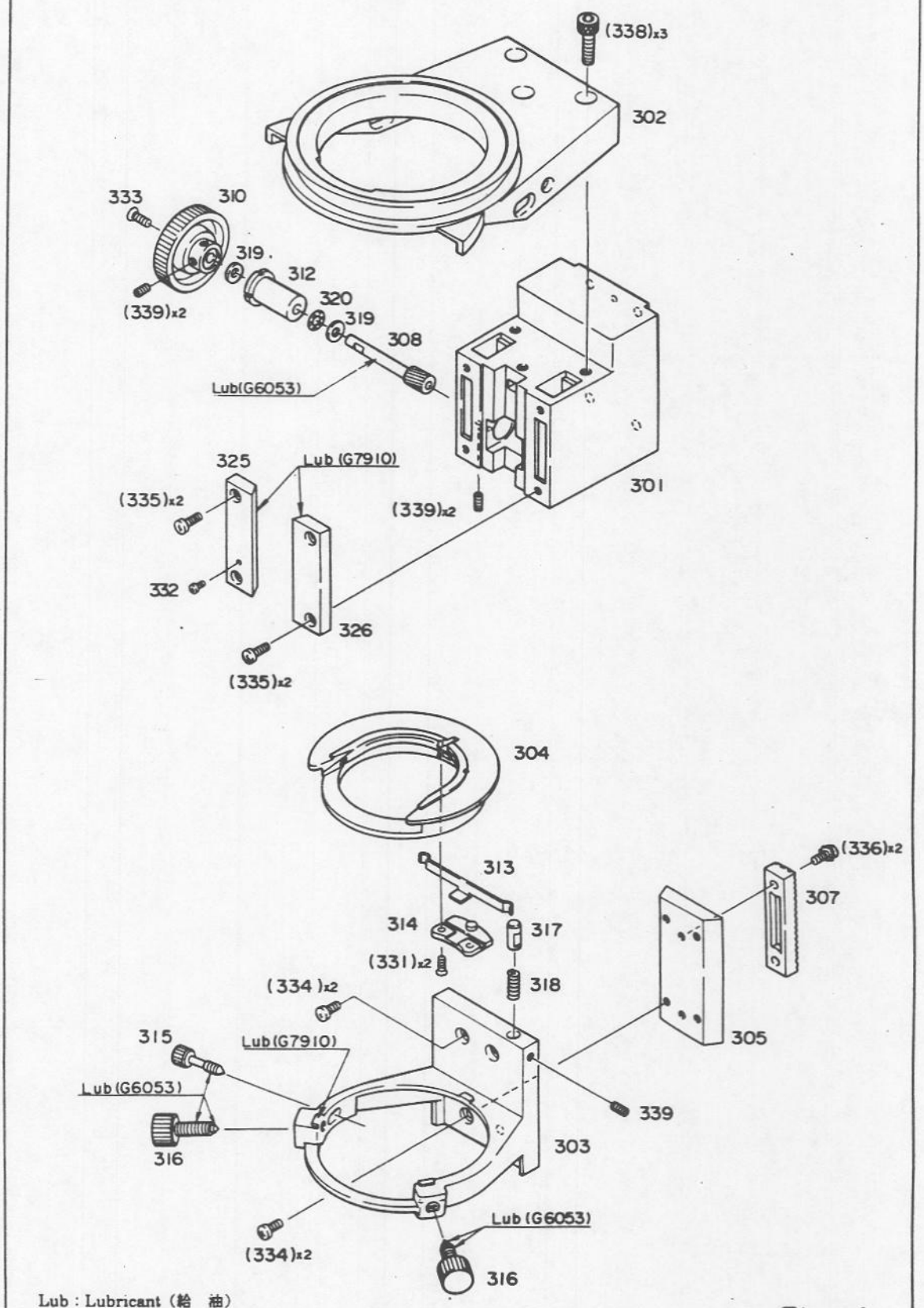
Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 2



Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 3



Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 4

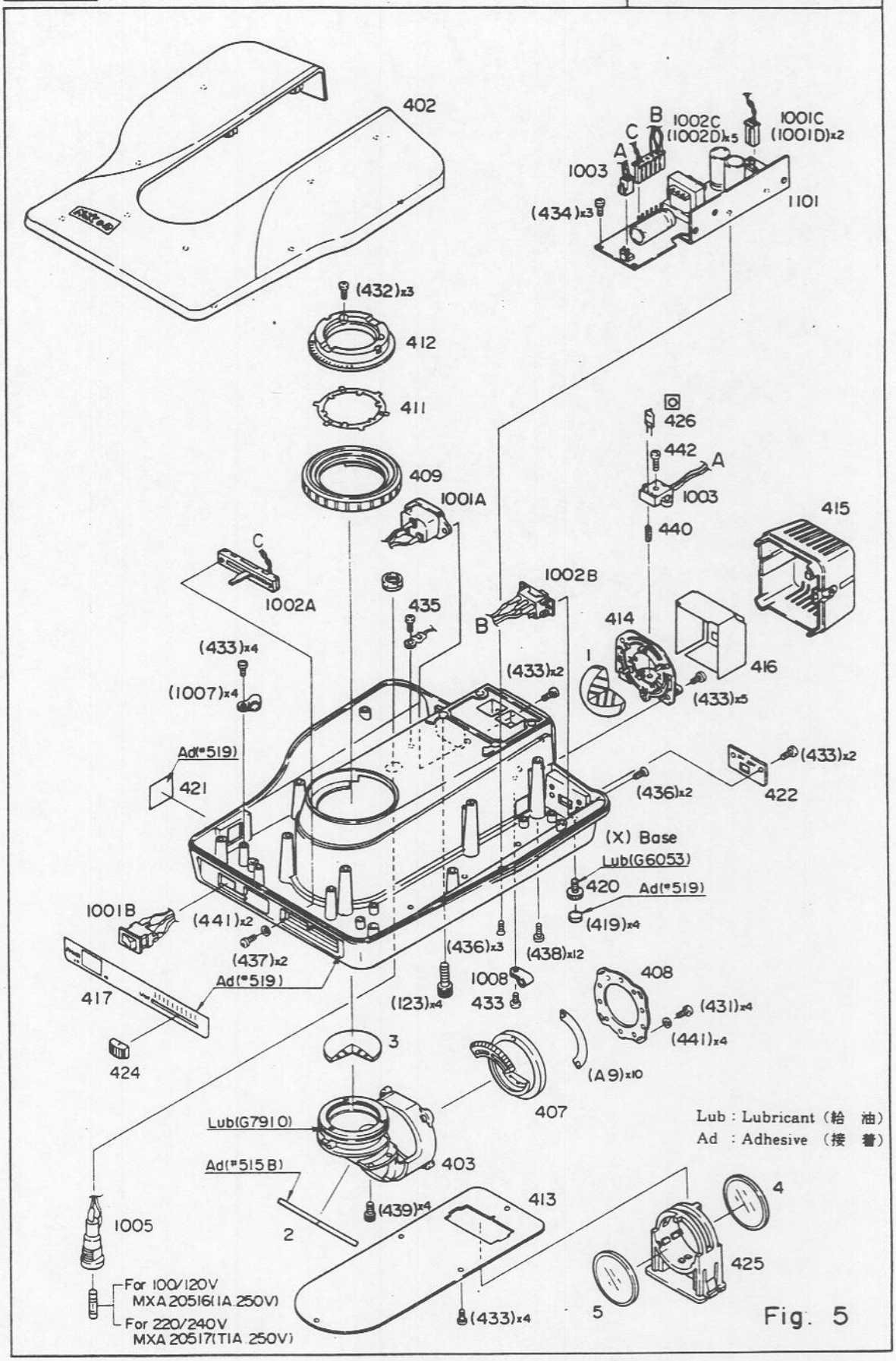
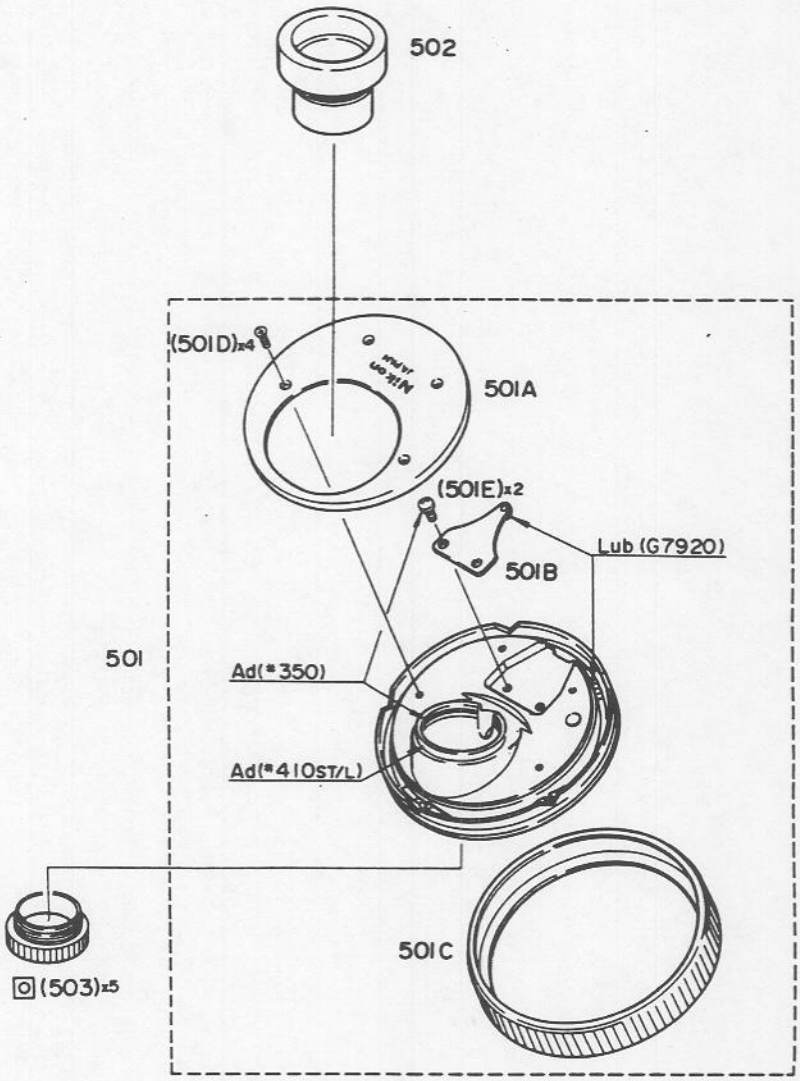

402
(432)x3
412
411
409
1001A
1002A
C
435
(433)x4
(1007)x4
Ad(*519)
421
1001B
(441)x2
(437)x2
Ad(*519)
417
424
1002C
(1002D)x5
1001C
(1001D)x2
1003
(434)x3
1101
426
442
A
1003
440
415
1002B
B
414
(433)x2
416
(433)x5
(436)x2
422
(433)x2
(X) Base
Lub(G6053)
420
Ad(*519)
(419)x4
(436)x3
(438)x12
(123)x4
1008
433
408
(431)x4
(441)x4
(A9)x10
3
407
Lub(G7910)
403
Ad(*515B)
2
(439)x4
413
1005
For 100/120V
MXA20516(1A 250V)
For 220/240V
MXA20517(TIA 250V)
(433)x4
4
425
5
Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 5



Lub : Lubricant (給　油)
Ad : Adhesive (接　着)

Fig. 6

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
1	2G301−007	Collector lens コレクタレンズ	1	5	●(G1 NEW)
2	2G552−003	Mirror ミラー	1	5	◎(G4), ●(G4), ◉(1), ⊗
3	2G114−018	Field lens フィールドレンズ	1	5	⊗
4	2G702−009	Diffuser 拡散板	1	5	⊗
5	2G702−010	Diffuser 拡散板	1	5	⊗
102	2K611−384	Arm rear cover アーム背面カバー	1	2	◉, ⊗
103	2K406−085	Eyepiece tube receptacle 鏡筒受け	1	2	鏡筒固定ねじ穴右側
103−1	2K406−085−1	Eyepiece tube receptacle 鏡筒受け	1	2	鏡筒固定ねじ穴左側
109	2K273−063	Rack ラック	1	2	◉, ⊗
111	2K078−002−1	Cylindrical roller 円筒コロ	24	2	◎(#11), ●(#11), ◉, ⊗
112	2K362−017	Retainer リテーナ	2	2	◎(#12), ●(#12), ◉, ⊗
113	2B680−095	Hexagon wrench 六角棒レンチ	1	2	◉, ⊗
114	2K601−793	Roller race cover ローラレースカバー	1	2	◉, ⊗
115A	2K600−191	Adjusting washer 調整ワッシャ（t = 0.05㎜）	n	2	◎(#15A), ●(#15A), ◉, ⊗
115B	2K600−192	Adjusting washer 調整ワッシャ（t = 0.08㎜）	n	2	◎(#15B), ●(#15B), ◉, ⊗
115C	2K600−193	Adjusting washer 調整ワッシャ（t = 0.11㎜）	n	2	◎(#15C), ●(#15C), ◉, ⊗

◎: 112MBと共通（Common to 112MB）
●: 111MBと共通（Common to 111MB）
◉: MBA13500と共通（Common to MBA13500）
⊗: MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
115D	2K600-194	Adjusting washer 調整ワッシャ（t = 0.03 ㎜）	n	2	◎(#15D), ●(#15D), ◉, ⊗
119	2K021-046	HSB3 × 0.5 × 6 六角穴付きボルト	3	2	●, ⊗ セムスK（小形平座金付き）
120	2K021-047	HSB3 × 0.5 × 8 六角穴付きボルト	3	2	●, ⊗ セムスK（小形平座金付き）
121	2K021-048	HSB4 × 0.7 × 8 六角穴付きボルト	6	2	●, ⊗ セムスK（小形平座金付き）
123	2K021-007	HSB6 × 20 六角穴付きボルト	4	5	◎(#43B), ●(#43B), ●, ⊗ セムスK（小形平座金付き）
125	2K625-410-1	Cover plate (Right) 飾り板（右）	1	2	⊗
126	2K625-409-1	Cover plate (Left) 飾り板（左）	1	2	◉, ⊗
127	2K681-789-1	Reversed nosepiece cover 逆レボカバー	1	2	◉, ⊗ 切欠き右側
127-1	2K681-789-2	Reversed nosepiece cover 逆レボカバー	1	2	◉, ⊗ 切欠き左側
128	2K115-523	Blank cap 盲蓋	1	2	
130	2K360-098	ide rail ル ドレール（L = 135 ㎜）	4	2	◉, ⊗
131	2K360-013	Guide rail ガイドレール（L = 108 ㎜）	4	2	◎(#10B), ●(#10B), ◉, ⊗
140	C1-20030 FC	⊕PM 2 × 3 ⊕なべ小ねじ	6	2	
141	C1-20030 FF	⊕PM 2 × 3 ⊕なべ小ねじ	4	2	

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⊗: MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
142	C1−30060 FE	⊕PM3×0.5×6 ⊕なべ小ねじ	3	3	
143	C1−30100 FE	⊕PM3×0.5×10 ⊕なべ小ねじ	1	2	
144	C2−30120 FE	⊕CM3×0.5×12 ⊕さら小ねじ	1	2	
145	L2−30080 FF	HSC3×0.5×8 六角穴付き止ねじとがり先	4	2	
146	M1−03006 FF	HSB3×0.5×6 六角穴付きボルト	3	3	
149	P4−20050 SX	SPL2×5 スプリングピン	7	2	
201	2K115−524	Fine focus knob cap 微動ハンドルゴムキャップ	2	3	◉, ⊗
202	2K201−128	Fine focus knob (Left) 微動ハンドル（左）	1	3	◉, ⊗ キー幅 1.2 ▬
202−1	2K201−128−1	Fine focus knob (Left) 微動ハンドル（左）	1	3	◉, ⊗ キー幅 1.7 ▬
203	2K201−129	Fine focus knob (Right) 微動ハンドル（右）	1	3	◉, ⊗ キー幅 1.2 ▬
203−1	2K201−129−1	Fine focus knob (Right) 微動ハンドル（右）	1	3	◉, ⊗ キー幅 1.7 ▬
204	2K201−130	Coarse focus knob (Left) 粗動ハンドル（左）	1	3	◉, ⊗
205	2K201−131	Coarse focus knob (Right) 粗動ハンドル（右）	1	3	◉, ⊗

◉：MBA13500と共通（Common to MBA13500）
⊗：MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　考
206	2K631−323	Fine focus thrust stopper 微動スラスト受け	1	3	◉, ⊗ キー溝幅 1.2 mm
206−1	2K631−323−1	Fine focus thrust stopper 微動スラスト受け	1	3	◉, ⊗ キー溝幅 1.7 mm
207	2K150−175	Circular nut 丸ナット	1	3	◉, ⊗
208	2K631−324	Pinion holder ピニオンホルダ	1	3	◉, ⊗
209	2K641−225	Adjustment ring supporter トルク調節リング	1	3	◉, ⊗
210	2B640−031	Torque adjustment ring トルク調節リング	1	3	◉, ⊗
213	2K160−790	Gear supporter 歯車支え板	1	3	◉, ⊗
215	2K631−325−2	Coarse focus shaft 粗動軸	1	3	◉, ⊗
217	2K641−228	Coarse focus knob supporter 粗動ハンドル受け	1	3	◉, ⊗
218	2K014−008	⊕PM3 × 0.5 × 6 ⊕なべ小ねじ	6	3	◉, ⊗ セムスC（外歯座金付き）
219	2K165−263	Delrin washer デルリンワッシャ	1	3	◉, ⊗
220	2K248−017	Belleville spring さらばね	1	3	◉, ⊗
221	2K165−264	Delrin washer デルリンワッシャ	1	3	◉, ⊗
222	2K246−134	Wave washer 波形座金	1	3	◉, ⊗
223	2K641−229	Friction disk トルク調節摩擦盤	1	3	◉, ⊗
225	2K260−131	Gear 歯車	1	3	◉, ⊗
226	2K260−132−2	Gear 歯車	1	3	◉, ⊗
227	2K260−133	Gear 歯車	1	3	◉, ⊗

◉：MBA13500と共通（Common to MBA13500）
⊗：MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
230	2B260−034	Gear 歯車	1	3	◉, ⊗
232	2B260−035	Fine focus shaft 微動軸	1	3	◉, ⊗ キー溝幅 1.2㎜
232−1	2B260−035−1	Fine focus shaft 微動軸	1	3	◉, ⊗ キー溝幅 1.2㎜
233	2K150−163	Circular nut 丸ナット	2	3	◉, ⊗
241	2K641−233	Cover ring カバーリング	1	3	
262	C1−30060 FE	⊕PM3×0.5×6 ⊕なべ小ねじ	6	3	
263	L3−30050 FE	HSH3×0.5×5 六角穴付き止ねじくぼみ先	4	3	
301	2K680−242−1	Substage サブステージ	1	4	Common to #201 in 112MB1 112MB1の#201と共通
302	2K420−053	Stage attaching dovetail ステージ取付けアリ	1	4	◎(#202), ●(#202), ◉, ⊗
303	2K680−196	Condenser carrier コンデンサキャリア	1	4	◎(#203), ●(#203), ◉, ⊗

◎：112MBと共通（Common to 112MB）
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Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
304	2K420-054	Condenser receptacle コンデンサ受け	1	4	◎(#204), ●(#204), ◉, ⊗
305	2K420-049	Dovetail 雌アリ	1	4	◎(#205), ●(#205), ◉, ⊗
307	2K273-015	Rack ラック	1	4	◎(#207), ●(#207), ◉, ⊗
308	2B264-001-1	Pinion ピニオン	1	4	◎(A 14), ●(A 14), ◉, ⊗
310	2B201-017	Condenser focus knob コンデンサ上下動ハンドル	1	4	◎(A 15), ●(A 15), ◉, ⊗
312	2K650-007	Pinion holder ピニオン軸受	1	4	◎(#212), ●(#212), ◉, ⊗
313	2K240-031	Leaf spring 板ばね	1	4	◎(#213), ●(#213), ◉, ⊗
314	2K625-059	Spring retainer ばね押え	1	4	◎(#214), ●(#214), ◉, ⊗
315	2K380-058	Condenser clamp screw コンデンサクランプねじ	1	4	◎(#215), ●(#215), ◉, ⊗
316	2B380-015	Condenser centering screw コンデンサ心出しねじ	2	4	◎(A 16), ●(A 16), ◉, ⊗
317	2K362-021-1	Stopper pin 制限ピン	1	4	◎(#217), ●(#217), ◉, ⊗
318	2K220-051	Coil spring コイルばね	1	4	◎(#218), ●(#218), ◉, ⊗ 加藤スプリング製作所 KC045-035-0100
319	2K165-077-1	Delrin washer デルリンワッシャ	2	4	◎(#219), ●(#219), ◉, ⊗
320	2K246-041	Wave washer 波形座金	1	4	◎(#220), ●(#220), ◉, ⊗
325	2K420-050	Dovetail groove (Left) 雌アリ (左)	1	4	◎(#206A), ●(#206A), ◉, ⊗
326	2K420-051	Dovetail groove (Right) 雌アリ (右)	1	4	◎(#206B), ●(#206B), ◉, ⊗

◎: 112MBと共通 (Common to 112MB)
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⊗: MBA33500と共通 (Common to MBA33500)

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
331	B2-20050 FF	JCIS⊕CM2×5 ③ JCIS⊕さら小ねじ	2	4	
332	2K003-019	⊕PM2×3 ⊕なべ小ねじ	1	4	◉, ⊗
333	C2-30060 FF	⊕CM3×0.5×6 ⊕さら小ねじ	1	4	
334	C1-30060 FF	⊕PM3×0.5×6 ⊕なべ小ねじ	4	4	
335	C1-30080 FF	⊕PM3×0.5×8 ⊕なべ小ねじ	4	4	
336	2K014-008	⊕PM3×0.5×6 ⊕なべ小ねじ	2	4	○(#234D), ●(#234D), ◉, ⊗ セムスC（外歯座金付き）
337	M1-04012 FE	HSB4×0.7×12 六角穴付きボルト	4	2	
338	M1-04014 FE	HSB4×0.7×14 六角穴付きボルト	3	4	
339	L3-30050 FF	HSH3×0.5×3 六角穴付き止ねじくぼみ先	5	4	
402	2K611-371-1	Base upper cover ベース上カバー	1	5	⊗
403	2K501-020-1	Field lens holder フィルドレンズホルダ	1	5	◉, ⊗
407	2B572-001	Blade guide way 矢車	1	5	◉, ⊗
408	2K574-042	Blade mount 蜂の巣	1	5	◉, ⊗
409	2B267-002-1	Field diaphragm control ring 視野絞り開閉リング	1	5	◉, ⊗

◉: MBA13500と共通（Common to MBA13500）
⊗: MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
411	2K240-264	Field lens retainer フィルドレンズ押え板ばね	1	5	◉, ⊗
412	2K475-049	Field diaphragm scale 視野絞り目盛環	1	5	◉, ⊗
413	2K087-698	Bottom plate 底板	1	5	
414	2K611-372-1	Lamp socket holder ランプソケットホルダ	1	5	⊗
415	2K681-776	Lamp house cover ランプハウスカバー	1	5	⊗
416	2K611-373	Heat resisting plate 耐熱板	1	5	⊗
417	2K087-665-1	Switch panel スイッチパネル	1	5	⊗
419	★2K110-427	Rubber foot ゴム足	4	5	◉, ⊗
420	2K380-233	Adjustable foot ベース高さ調節足	1	5	◉(429), ⊗
421	2K601-782	Blank cap 盲板	1	5	
422	2K083-316	Voltage select switch cover 電圧切換え表示銘板	1	5	◉, ⊗
424	2K681-772	Brightness control knob 調光つまみ	1	5	◉, ⊗
425	2K681-777	Filter cassette フィルタカセット	1	5	⊗
426	2S652-009	Halogen lamp ハロゲンランプ（6 V 30W）	1	5	⊗ ⊡ Delivered as a product 営業販売品

◉：MBA13500と共通（Common to MBA13500）
⊗：MBA33500と共通（Common to MBA33500）

May 1990 ★×1 Revised
改正

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
431	B1−20060 FE	JCIS⊕PM2×6 ③ JCIS⊕なべ小ねじ	4	5	
432	B1−20080 FF	JCIS⊕PM2×8 ③ JCIS⊕なべ小ねじ	3	5	
433	C1−30060 FE	⊕PM3×0.5×6 ⊕なべ小ねじ	18	5	
434	2K014−001	⊕PM3×0.5×6 ⊕なべ小ねじ	3	5	◎(#451A)、●(#41F)、●(449)、⊗ セムスA（ばね座金付き）
435	2K014−027	⊕PM4×0.7×6 ⊕なべ小ねじ	1	5	◉(448)、⊗ セムスA（ばね座金付き）
436	C2−30060 FE	⊕CM3×0.5×6 ⊕さら小ねじ	5	5	
437	B1−20050 FE	JCIS⊕PM2×5 ③ JCIS⊕なべ小ねじ	2	5	
438	F1−26140 FA	⊕PT2.6×14 ② ⊕なべタッピンねじ	12	5	
439	2K021−037	HSB3×0.5×8 六角穴付きボルト	4	5	◉(452)、⊗ セムスK（小形平座金付き）
440	P3−30060 SX	SPN3×6 スプリングピン	1	5	
441	R1−02000 FE	PWS2 平座金小形丸	6	5	
442	C1−20120 FC	⊕PM2×12 ⊕なべ小ねじ	1	5	

◎：112MBと共通（Common to 112MB）
●：111MBと共通（Common to 111MB）
◉：MBA13500と共通（Common to MBA13500）
⊗：MBA33500と共通（Common to MBA33500）

Index No. 補助番号	Part No. 部品番号	Name 名　　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　　考
501	2B001−120−1	Nosepiece レボルバ	1	6	⊖(301)
501A	2K080−031	Cover plate 飾り板	1	6	⊖(301A)
501B	2B240−008	Click spring クリックばね	1	6	⊖(301B)
501C	2K640−783	Revolving ring レボルバ回転環	1	6	⊖(301C)
501D	A2−20025FC	JCIS⊕CM2×2.5 ① JCIS⊕さら小ねじ	4	6	
501E	B1−26045FA	JCIS⊕PM2.6×4.5 JCIS⊕なべ小ねじ	2	6	
502	2K576−233−1	Circular nut 丸ナット	1	6	Common to 302 in MBP31102 MBP31102の302と共通
503	2K467−003	Nosepiece cap レボルバ用対物キャップ	5	6	⊖(302) ◎ Delivered as a product 営業販売品
1001A	2S418−018	AC inlet ACインレット	1	5	◉, ⊗ 平河電線　CM−12
1001B	2S423−028	See-saw switch シーソースイッチ	1	5	◉, ⊗ マッカート　1852−0122
1001C	2S400−667	Socket housing ソケットハウジング	1	5	◉, ⊗ 日本圧着端子　S2P−SVF　2極
1001D	2S400−669	Socket contact ソケットコンタクト	2	5	◉, ⊗ 日本圧着端子　SVF−01T−1.5N 1002Dと共通
1002A	2S322−137	Slide variable resistor スライド可変抵抗器	1	5	◉(1003A), ⊗(1005A) 帝国通信工業　VJ4513−4N15C−10A10 10KΩJ　Aカーブ
1002B	2S424−032	Slide switch スライドスイッチ	1	5	フジソク　S−1　UL

◉：MBA13500と共通（Common to MBA13500）
⊗：MBA33500と共通（Common to MBA33500）
⊖：MBA31103と共通（Common to MBA31103）

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
1002C	2S400-668	Socket housing ソケットハウジング	1	5	日本圧着端子 S6P-SVF 6極
1002D	2S400-669	Socket contact ソケットコンタクト	5	5	◉(1001D), ⊗(1001D) 日本圧着端子 SVF-01T-1.5N 1001Dと共通
1003	2S040-578	Lamp socket with cable ケーブル付きランプソケット	1	5	⊗
1005	2S463-036	Fuse holder ヒューズホルダ	1	5	◉(1006), ⊗(1006) マル信 MF527
1007	2S740-047	Cable clamp ケーブルクランプ	4	5	●(1009), ⊗(1009) 北川工業 NK-5N φ8.4
1008	2S740-063	Cable clamp ケーブルクランプ	1	5	⊗(1010) 北川工業 KCA-34 φ4.3
1101	2S001-034-1	Brightness controller 調光装置（6V 30W）	1	5	⊗ Common to 1201in MCA14100 MCA14100の1201と共通
A1	A1	Eyepiece tube lock screw 鏡筒固定ねじ	1	2	◉, ⊗
A3	A3	Guide rail holder (Left) ガイドレールホルダ（左）	1	2	◉, ⊗
A4	A4	Guide rail holder (Right) ガイドレールホルダ（右）	1	2	◉, ⊗
A5	A5	Gear holder 歯車ホルダ	1	3	◉, ⊗
A6	A6	Pinion ピニオン	1	3	◉, ⊗
A7	2B260-036	Gear 歯車	1	3	◉, ⊗
A9	2B570-022	Blade 絞り羽根	10	5	◉, ⊗ Common to 121 in MAA15500 MAA15500の121と共通

◉: MBA13500と共通（Common to MBA13500）
⊗: MBA33500と共通（Common to MBA33500）

KR-7263.A

STAGES
FOR
MICROSCOPE OPTIPHOT-2, LABOPHOT-2

顕微鏡OPTIPHOT-2, LABOPHOT-2用ステージ

REPAIR PARTS LIST

修 理 部 品 表

NIKON CORPORATION

Tokyo, Japan

(91.9.210)H

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§. MBC21102 (Rectangular Mechanical Stage "R2")

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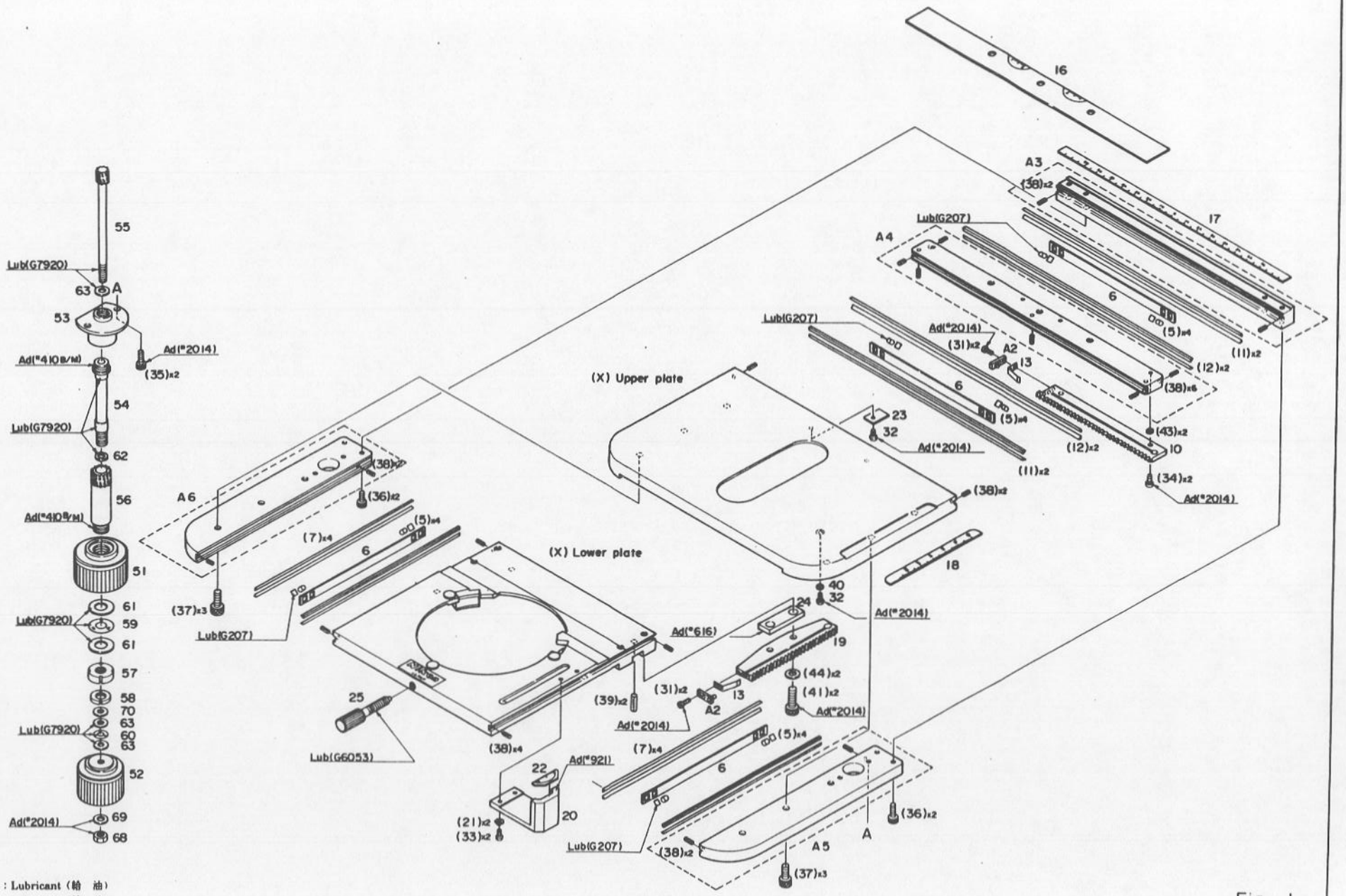
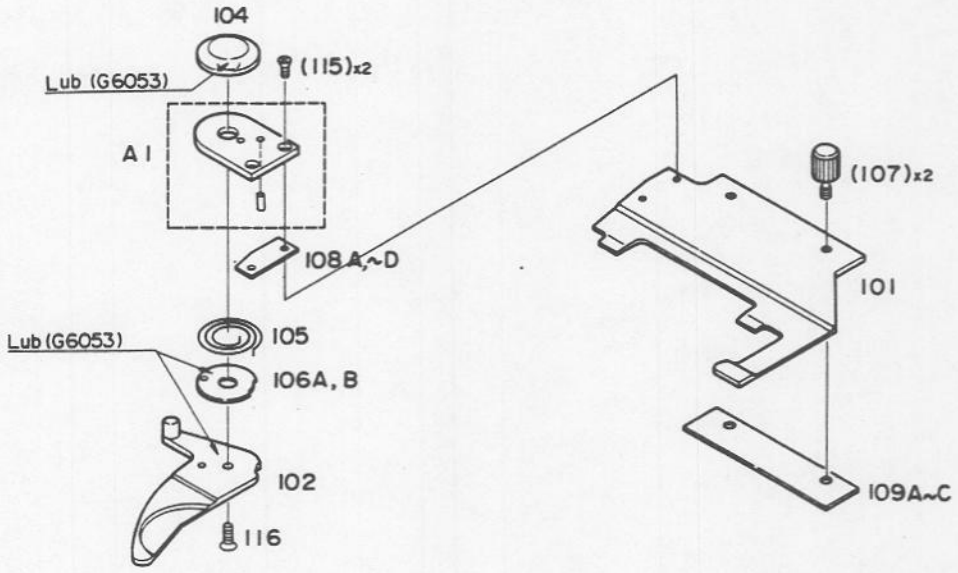


Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 1



Lub : Lubricant (給 油)
Ad : Adhesive (接 着)

Fig. 2

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Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
5	2K078-003-1	Cylindrical roller 円筒コロ（D = 3.175 mm）	16	1	◎, ◉, ●, ⊗ (6)
6	2K347-005	Retainer リテーナ	4	1	◎, ◉, ●, ⊗ (7)
7	2K360-005	Guide rail ガイドレール（L = 126 mm）	8	1	◎, ◉, ●, ⊗ (73)
10	2K273-035-2	Rack (Lateral) ラック（左右用）	1	1	◎, ◉
11	2K360-006	Guide rail ガイドレール（L = 174 mm）	4	1	◎, ◉, ●, ⊗ (74)
12	2K360-007	Guide rail ガイドレール（L = 184 mm）	4	1	◎, ◉, ●, ⊗ (75)
13	2K240-105	Leaf spring 板ばね	2	1	◎, ◉, ●, ⊗ (45)
16	2K470-079	Vernier (Lateral) 副尺（左右用）	1	1	◎, ◉, ●
17	2K470-016	Scale (Lateral) 主尺（左右用）	1	1	◎, ◉, ●, ⊗ (28)
18	2K470-050	Scale (Longitudinal) 主尺（前後用）	1	1	◎, ◉, ●
19	2K273-051-3	Rack (Longitudinal) ラック（前後用）	1	1	◎, ◉
20	2K680-021-2	Vernier mount 副尺座	1	1	◎, ◉, ●, ⊗ (27)
21	2K058-004	Toothed washer 歯付き座金－2	2	1	◎, ◉, ●, ⊗ (66)
22	2K470-002	Vernier (Longitudinal) 副尺（前後用）	1	1	◎, ◉, ●, ⊗ (31)
23	2K600-071-1	Stopper ストッパ	1	1	◎, ◉, ●, ⊗ (26)
24	2K600-617-1	Spacer スペーサ	1	1	◎, ◉, ●, ⊗ (47-1)
25	2B380-010-1	Stage clamp screw ステージクランプねじ	1	1	◎, ◉, ⊗ (A5-1)

◎：MBC21100と共通 (Common to MBC21100)
◉：MBC21103と共通 (Common to MBC21103)
●：MBC21000と共通 (Common to MBC21000)
⊗：MBC11101と共通 (Common to MBC11101)

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
31	A1-17040FC	JCIS ⊕ PM 1.7×4 ① JCIS ⊕ なべ小ねじ	4	1	
32	A1-20040FC	JCIS ⊕ PM 2×4 ① JCIS ⊕ なべ小ねじ	2	1	
33	B1-20040FC	JCIS ⊕ PM 2×4 ③ JCIS ⊕ なべ小ねじ	2	1	
34	B1-20050FC	JCIS ⊕ PM 2×5 ③ JCIS ⊕ なべ小ねじ	2	1	
35	M1-03006FF	HSB3×0.5×6 六角穴付きボルト	2	1	
36	M1-03010FF	HSB3×0.5×10 六角穴付きボルト	4	1	
37	M1-04008FF	HSB4×0.7×8 六角穴付きボルト	6	1	
38	P3-20050SX	SPN 2×5 スプリングピン	18	1	
39	P3-30100SX	SPN 3×10 スプリングピン	2	1	
40	R1-02000FY	PWS 2 平座金小形丸	1	1	
41	M1-04012FF	HSB 4×0.7×12 六角穴付きボルト	2	1	
43	2K160-276	Washer 座金	2	1	◎, ◉, ●
44	R1-04000FF	PWS 4 平座金小形丸	2	1	

◎ : MBC21100と共通 (Common to MBC21100)
◉ : MBC21103と共通 (Common to MBC21103)
● : MBC21000と共通 (Common to MBC21000)

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
51	2B201-001	Knob (Longitudinal) ハンドル（前後用）	1	1	◎, ◉, ⊗ (13)
52	2B201-002	Knob (Lateral) ハンドル（左右用）	1	1	◎, ◉, ⊗ (14)
53	2K340-006-1	Pinion cover ピニオンカバー	1	1	◎, ◉, ● (61), ⊗ (9)
54	2K630-005-1	Pinion holder ピニオン軸受	1	1	◎, ◉
55	2K264-010-1	Pinion (Lateral) ピニオン（左右用）	1	1	◎, ◉
56	2K264-041	Pinion (Longitudinal) ピニオン（前後用）	1	1	◎, ◉
57	2K156-020	Nut ナット	1	1	◎, ◉, ⊗ (15)
58	2K156-021	Nut ナット	1	1	◎, ◉, ⊗ (16)
59	2K246-058	Wave washer 波形座金	1	1	◎, ◉, ⊗ (17 NEW)
60	2K246-059	Wave washer 波形座金	1	1	◎, ◉, ⊗ (18 NEW)
61	2K165-050	Delrin washer デルリンワッシャ	2	1	◎, ◉, ⊗ (19)
62	2K165-051	Delrin washer デルリンワッシャ	1	1	◎, ◉, ● (63), ⊗ (20)
63	2K165-061	Delrin washer デルリンワッシャ	3	1	◎, ◉, ● (64), ⊗ (21)
68	N1-04000FY	HN 4 ① 六角ナット	1	1	
69	R1-04000FY	PWS 4 平座金小形丸	1	1	
70	R1-04000BX	PWS 4 平座金小形丸	1	1	

◎：MBC 21100 と共通 (Common to MBC 21100)
◉：MBC 21103 と共通 (Common to MBC 21103)
●：MBC 21000 と共通 (Common to MBC 21000)
⊗：MBC 11101 と共通 (Common to MBC 11101)

Index No. 補助番号	Part No. 部品番号	Name 名称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備考
101	2K625-167-1	Specimen holder 標本ホルダ	1	2	⊗ (32-1)
102	2B625-011	Specimen clip 標本押え	1	2	⊗ (A7)
104	2K370-057	Specimen clip thrust metal 標本押えスラスト受け	1	2	◎, ●, ⊗ (35)
105	2K230-003	Spiral spring 渦巻ばね	1	2	◎, ⊗ (36)
106A	2K600-072-1	Adjusting washer 調整ワッシャ (t = 0.4 mm)	n	2	◎, ●, ⊗ (37A)
106B	2K600-073-1	Adjusting washer 調整ワッシャ (t = 0.5 mm)	n	2	◎, ●, ⊗ (37B)
107	2K380-033	Specimen holder clamp screw 標本ホルダ固定ねじ	2	2	◎, ●, ⊗ (39)
108A	2K600-074	Adjusting washer 調整ワッシャ (t = 0.3 mm)	n	2	◎, ●, ⊗ (40A)
108B	2K600-075	Adjusting washer 調整ワッシャ (t = 0.4 mm)	n	2	◎, ●, ⊗ (40B)
108C	2K600-076	Adjusting washer 調整ワッシャ (t = 0.5 mm)	n	2	◎, ●, ⊗ (40C)
108D	2K600-077	Adjusting washer 調整ワッシャ (t = 0.6 mm)	n	2	◎, ●, ⊗ (40D)
109A	2K600-078	Adjusting washer 調整ワッシャ (t = 0.2 mm)	n	2	◎, ●, ⊗ (41A)
109B	2K600-079	Adjusting washer 調整ワッシャ (t = 0.3 mm)	n	2	◎, ●, ⊗ (41B)
109C	2K600-080	Adjusting washer 調整ワッシャ (t = 0.4 mm)	n	2	◎, ●, ⊗ (41C)
115	B2-20040FC	JCIS ⊕ CM 2×4 ③ JCIS ⊕ さら小ねじ	2	2	
116	2K003-004	⊕ CM 3×0.5×5 ⊕さら小ねじ	1	2	◎, ●, ⊗ (64)

◎ : MBC 21100 と共通 (Common to MBC 21100)
● : MBC 21000 と共通 (Common to MBC 21000)
⊗ : MBC 11101 と共通 (Common to MBC 11101)

Index No. 補助番号	Part No. 部品番号	Name 名　称	Pcs.per Unit 1台分個数	Reference Fig.No. 参照図番	Remarks 備　考
A1	A1	Specimen clip supporter 標本押え保持金物	1	2	◎, ⊗ (A6R)
A2	A2	Leaf spring retainer (stopper) 板ばね押え	2	1	◎, ◉, ●, ⊗ (A8)
A3	A3	Roller race ローラレース	1	1	◎, ◉, ●
A4	A4	Roller race ローラレース	1	1	◎, ◉
A5	A5	Roller race ローラレース	1	1	◎, ◉, ●
A6	A6	Roller race ローラレース	1	1	◎, ◉, ●

◎ : MBC 21100 と共通 (Common to MBC 21100)
◉ : MBC 21103 と共通 (Common to MBC 21103)
● : MBC 21000 と共通 (Common to MBC 21000)
⊗ : MBC 11101 と共通 (Common to MBC 11101)

Nikon

Biological Microscope

LABOPHOT

(Y-R stand)

INSTRUCTIONS

NIPPON KOGAKU K.K.

CAUTIONS

❶ Avoid sharp knocks!

Handle the microscope gently, taking care to **avoid sharp knocks.**

❷ When carrying the microscope

When carrying the microscope, hold its arm with one hand, supporting the bottom of the microscope base with the other. The instrument weighs about 8 kg.

❸ Place for using

Avoid the use of the microscope in a dusty place, where it is subject to **vibrations** or exposed to **high temperatures, moisture** or **direct sunlight.**

❹ Light source

Use halogen lamp **6V – 20W.**

❺ In lighting the lamp

Take care **not to touch the rear cover of the lamp being lighted, and don't bring inflammable substances** such as gasoline, thinner, and alcohol near to the cover, as it may take a high temperature while the lamp is being lighted.

❻ Exchanging the lamp bulb and fuse

Before replacing the lamp bulb (6V – 20W) or fuse, **turn OFF the power switch and disconnect the plug of the power source cord.**

In such cases as of replacement, **do not touch the lamp bulb with bare hands,** immediately after putting out the lamp.

❼ Dirt on the lens

Do not leave **dust, dirt or finger marks** on the lens surfaces. They will prevent you from clear observation of the specimen image.

❽ Focus knobs

Never attempt to adjust the tightness of the right- and lefthand focus knob **by turning the one, while holding the other** in this model microscope, because of causing disorder.

CARE AND MAINTENANCE

❶ Cleaning the lenses

To clean the lens surfaces, remove dust using a soft brush or gauze. Only for removing finger marks or grease, should soft cotton cloth, lens tissue or gauze lightly moistened with absolute alcohol (ethanol or methanol) be used.

For cleaning the objectives and immersion oil use only xylene.

For cleaning the surface of the entrance lens of the eyepiece tube and the prism surface of the Trinocular Eyepiece Tube "T" or the Ultra Wide Eyepiece Tube "UW", use absolute alcohol.

Observe sufficient caution in handling alcohol and xylene.

❷ Cleaning the painted surfaces

Avoid the use of any organic solvent (for example, thinner, ether, alcohol, xylene etc.) for cleaning the painted surfaces and plastic parts of the instrument.

❸ Never attempt to dismantle !

Never attempt to dismantle the instrument so as to avoid the possibility of impairing the operational efficiency and accuracy.

❹ When not in use

When not in use, cover the instrument with the accessory vinyl cover, and store it in a place free from moisture and fungus.

It is especially recommended that the objectives and eyepieces be kept in an air-tight container containing desiccant.

❺ Periodical checking

To maintain the performance of the instrument, we recommend to check the instrument periodically. (For details of this check, contact our agency.)

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I . NOMENCLATURE

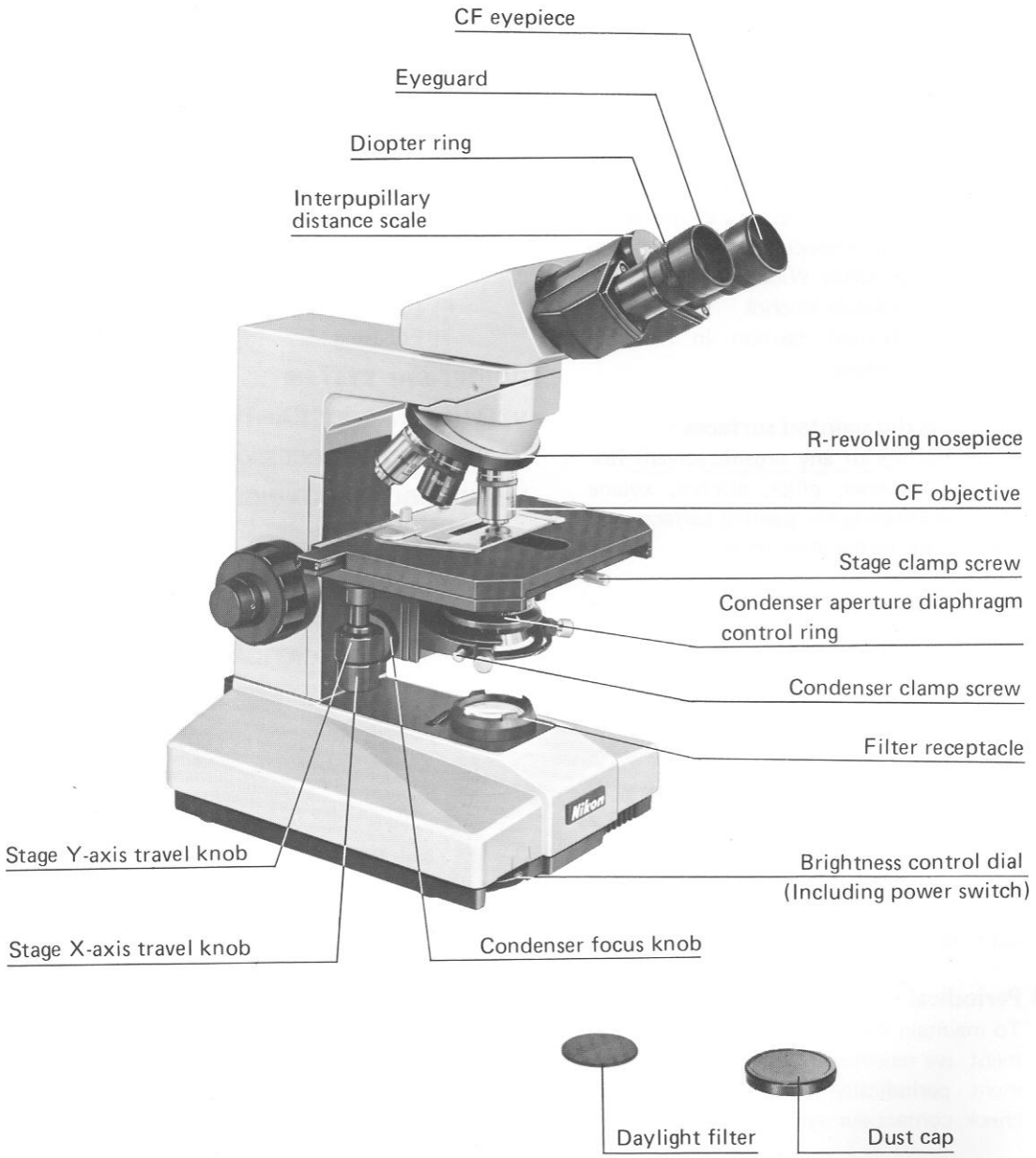


Fig. 1

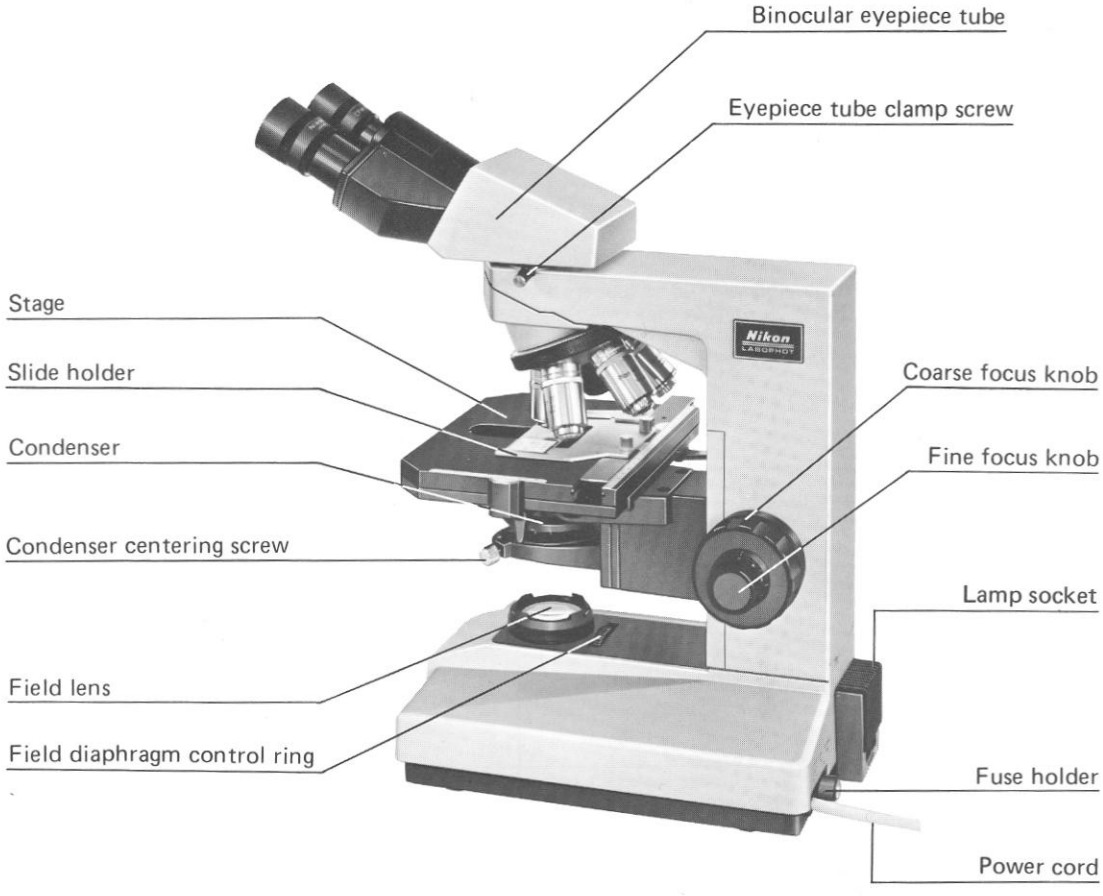

Binocular eyepiece tube
Eyepiece tube clamp screw
Stage
Slide holder
Condenser
Condenser centering screw
Field lens
Field diaphragm control ring
Coarse focus knob
Fine focus knob
Lamp socket
Fuse holder
Power cord
Nikon
LABOPHOT

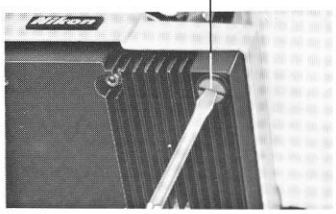
Fig. 2

II. ASSEMBLY

- **To assemble the microscope, follow the procedure in the order given:**

① Leveling foot screw

For stable installation of the microscope, manipulate the adjusting screw at one foot on the bottom of the microscope base.



② Lamp bulb

Insert the lamp bulb with its pins into the accepting hole in the socket.
Note: Don't touch the bulb surface directly with the fingers.

Power cord

Condenser clamp screw

Y-R stand

③ Lamp socket

Insert the socket into the receptacle on the microscope base.

⑨ Daylight filter

Place the filter on the field lens. 45 mm in diameter.

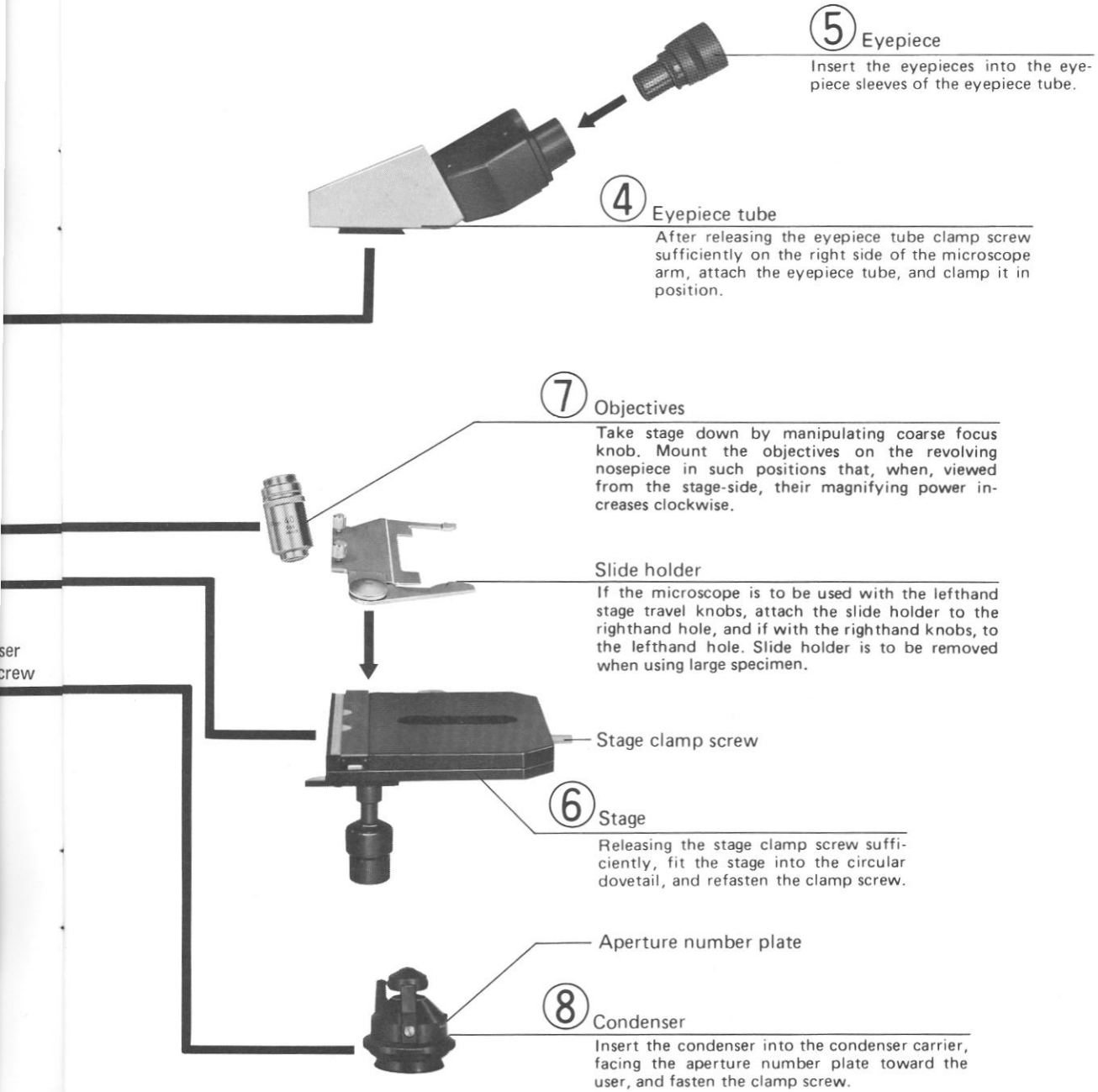

5 Eyepiece
Insert the eyepieces into the eyepiece sleeves of the eyepiece tube.
4 Eyepiece tube
After releasing the eyepiece tube clamp screw sufficiently on the right side of the microscope arm, attach the eyepiece tube, and clamp it in position.
7 Objectives
Take stage down by manipulating coarse focus knob. Mount the objectives on the revolving nosepiece in such positions that, when, viewed from the stage-side, their magnifying power increases clockwise.
Slide holder
If the microscope is to be used with the lefthand stage travel knobs, attach the slide holder to the righthand hole, and if with the righthand knobs, to the lefthand hole. Slide holder is to be removed when using large specimen.
Stage clamp screw
6 Stage
Releasing the stage clamp screw sufficiently, fit the stage into the circular dovetail, and refasten the clamp screw.
Aperture number plate
8 Condenser
Insert the condenser into the condenser carrier, facing the aperture number plate toward the user, and fasten the clamp screw.

Fig. 3

III. MICROSCOPY

1. Operating Procedure

1) Turn the brightness control dial (including power switch) to ON and set the scale on the dial to 4.
2) Remove the dust cap and place the daylight filter onto the field lens.
3) Place the specimen on the stage and swing the 10× objective into position. Focus on specimen.
4) Adjust the interpupillary distance and diopter. (Refer to P. 9)
5) Carry out the centering procedure for the condenser. (Refer to P. 10)
6) Swing in the objective to be used and refocus on specimen.
7) Adjust the condenser. (Refer to Table 1)

Table 1. Use of Condensers

<table>
<tr><th>Type of condenser / Object distance / Objective</th><th>Abbe condenser N.A. = 1.25</th><th>Swing-out Achromat condenser N.A. = 0.9 Dry system</th><th>Achromat/aplanat condenser N.A. = 1.35 Oil-immersion</th></tr>
<tr><td></td><td>2mm</td><td>1.8mm</td><td>1.6mm</td></tr>
<tr><td>1×</td><td rowspan="2">Remove the condenser</td><td>Remove the condenser</td><td rowspan="3">Remove the condenser</td></tr>
<tr><td>※2×</td><td rowspan="2">Top lens swung out</td></tr>
<tr><td>※4×</td><td rowspan="3">Usable</td></tr>
<tr><td>10×</td><td rowspan="2">Top lens swung in</td></tr>
<tr><td>20×
40×
100×</td><td>Usable</td></tr>
</table>

[NOTE]
- The above object distance (from the top of the condenser lens to the specimen surface) includes a glass slide thickness 1.2mm.
- ※● When using the Swing-out condenser with 2× or 4× objective, fully open its aperture diaphragm.
- UW (ultra-wide) viewfield observation is possible with 2× ~ 100× objective. In combination with the Abbe condenser, however, the use of the 10× or higher objective is possible.
- For photomicrography using the 4× or lower objective, remove the Abbe condenser.
- For photomicrography using the 2× objective, preferably remove the condenser.
- For observation with the 1× objective, additionally use the diffuser. (available on order).
- The Achromat/aplanat condenser is not included in the standard set.

8) Brightness is adjusted by changing the lamp voltage.
9) Adjust the condenser aperture diaphragm and the field diaphragm. (Refer to P. 10, 11)

2. Manipulation of Each Element

1) Interpupillary distance adjustment

Place a specimen on the stage, and focus on the specimen. As shown in Fig. 4, adjust the interpupillary distance, so that both the right and left viewfields become one.

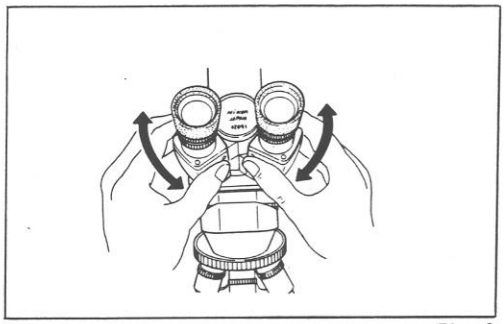


Fig. 4

2) Diopter adjustment

Make diopter adjustment for both the right and lefthand eyepieces.

(1) Turn the diopter ring on each eyepiece, until the end surface of the milled ring coincides with the engraved line, as shown in Fig. 5.

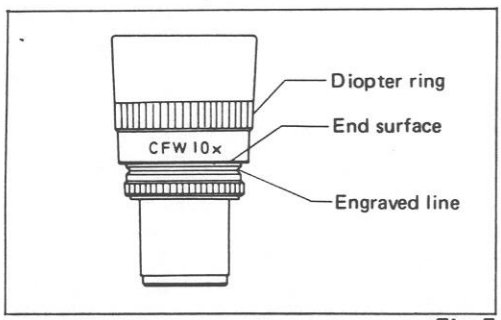


Fig. 5

(2) Mount the specimen on the stage. Swing the objective 40X into position, and bring the specimen image into focus. For facilitating the focusing, first use the 10X and then 40X objective.

(3) Thereupon, swing the objective 4X into position.
Without manipulating the coarse and fine focus knob, turn the diopter rings on the eyepieces, so that the specimen images in the right and lefthand eyepieces are focused individually.

- Repeat the above procedure two times, and a perfect diopter adjustment will be achieved.
- The above adjustment, compensating the diopter difference between the user's right and left eyes, will keep the tube length of microscope correct, thus enabling him to realize the full advantages of the highclass objectives, including their parfocality.

(4) Since the CF eyepieces are of high eyepoint type, it is not necessary for the user putting on his spectacles to remove them.
Only fold down the eyeguard rubber.
(Fig. 7)

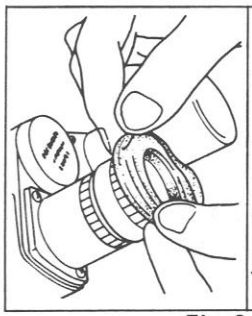


Fig. 6

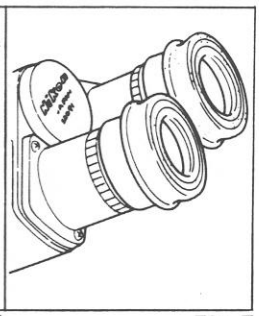


Fig. 7

3) Optical path change-over in the trinocular eyepiece tube

(1) When using the trinocular eyepiece tube "F"
As shown in Fig. 8, when the observation tube is turned toward the user, 100% of light enters the observation tube.

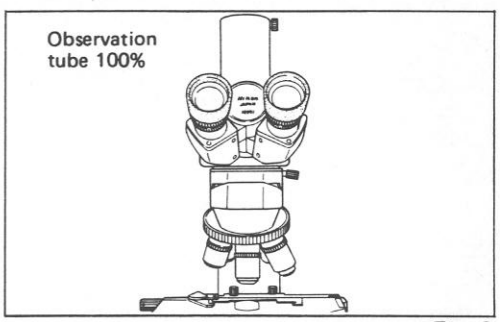


Fig. 8

As shown in Fig. 9, when the observation tube is revolved 60° leftward, 100% of light enters the vertical photo tube.
In either case, turn the tube to the limit.

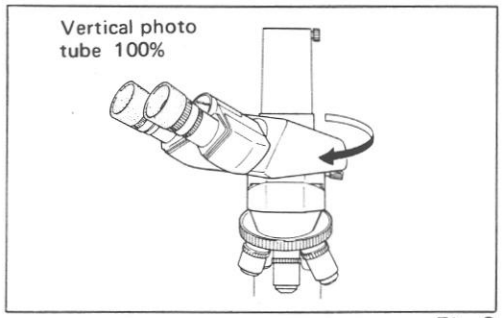


Fig. 9

(2) When using the trinocular eyepiece tube "T" or the ultra wide eyepiece tube "UW"

As shown in Fig. 10, with the change-over knob pushed in, 100% of light enters the observation tube.

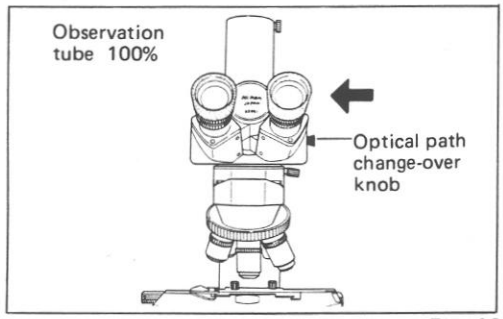


Fig. 10

As shown in Fig. 11, with the change-over knob drawn out, the proportion of light entering the binocular observation tube and vertical photo tube will be 14 : 86.

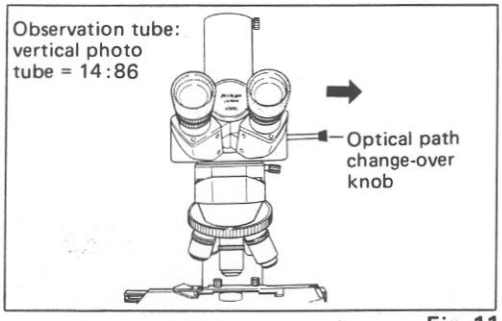


Fig. 11

4) Centering the condenser lens

(1) Close the field diaphragm in the microscope base to its smallest size by means of the field diaphragm control ring. Rotate the condenser focus knob to move the condenser vertically so that a sharp image of the field diaphragm is formed on the specimen surface.

(2) Bring the field diaphragm image to the center of the field of view by means of the condenser centering screws. (Fig. 12-1)

(3) Change over to the 40X objective, and adjust the field diaphragm so that the image of the diaphragm is about the same as that of the field of view, as shown in Fig. 12-2. If not centered, use the condenser centering screws again.

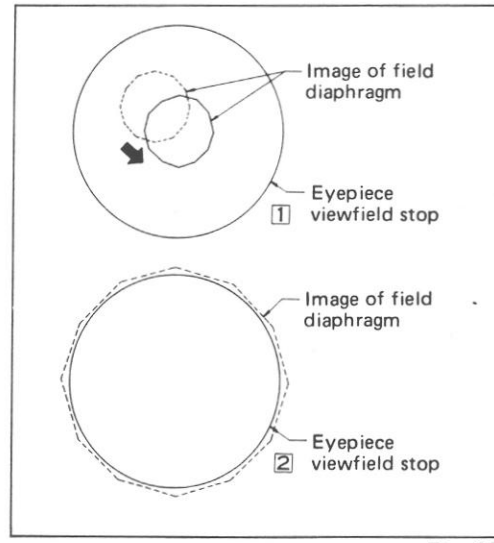


Fig. 12

5) Use of condenser aperture diaphragm

The condenser aperture diaphragm is provided for adjusting the numerical aperture (N.A.) of the illuminating system of microscope. It is important because it determines the resolution, contrast and depth of focus.

In general, when it is stopped down to 70 ~ 80% of the numerical aperture of the objective, a good image of appropriate contrast will be obtained. (Fig. 13)

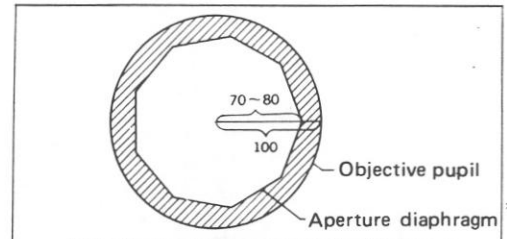


Fig. 13

The graduation on the Abbe condenser indicates the diameters in mm of the aperture diaphragm opening of condenser.

After removing the eyepiece from the eyepiece tube, adjust the size of the diaphragm, observing the image of the diaphragm which is visible on the bright circle of exit pupil of objective inside.

It is recommended to take note of the diameter of the diaphragm opening for each objective power, whereby the best image is obtained.

The Swing-out Achromat and Achromat/aplanat condensers, however, have a graduation indicating the numerical apertures (N.A.), and not the diameters of diaphragm opening.

Manipulation of these condensers is the same as that of the Abbe condenser. Stopping down the aperture diaphragm too far will deteriorate the image quality of microscope due to diffraction of light. Therefore, it is not recommended to stop down the aperture to a size smaller than 60% of the N.A. of the objective in use except when observing almost transparent specimen.

6) Use of field diaphragm

The field diaphragm is used for determining the illuminated area on the specimen surface in relation to the field of view of the microscope. Generally, it is stopped down to such an extent that the circumference of the illuminated area circumscribes or inscribes that of the eyepiece field of view. If the former be larger than the latter, extraneous light will enter the field of view, causing flare in the image and lowering the contrast. Therefore, especially in photomicrography, the proper adjustment of the field diaphragm is very important. Generally, good results will be achieved when the diaphragm is stopped down to such an extent that the diameter of illuminated area is slightly larger than the diagonal of film format.

7) Focusing

The relation between the direction of rotation of the focus knobs and that of vertical movement of the stage is as indicated in Fig. 14.

One rotation of the fine focus knob moves the stage 0.2mm.

The graduation on this focus knob is divided into 2μm.

One rotation of the coarse focus knob moves the stage 4.7mm.

The range of coarse and fine motion is within 30mm; 2mm up and 28mm down from the standard position.

Tightness of the coarse-fine focus knob having been properly adjusted by the manufacturer, it should never be readjusted in this model microscope by turning the one knob while holding the other.

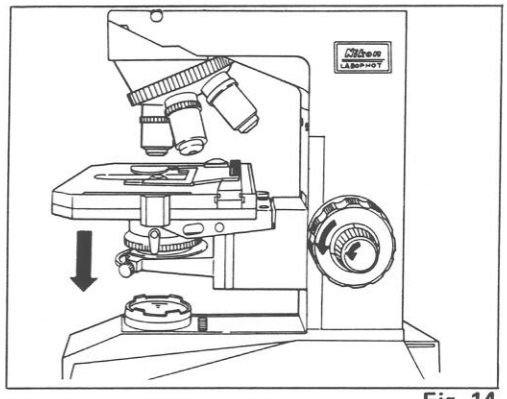


Fig. 14

IV. OPTICAL SYSTEM

The CF objectives and CF eyepieces adopted in the Nikon Biological Microscope LABOPHOT are designed on the basis of a new Nikon-developed concept "Chromatic Aberration Free" With the Nikon CF optical system the chromatic difference of magnification in the objective and eyepiece is individually corrected. This is unlike conventional microscopes where the corrections of such aberration has been, for the most part, compensated for in the objectives and eyepiece as a pair. As a result the Nikon Microscope LABOPHOT has no orange colored fringe in the eyepiece. In cooperation with the other optimum aberration corrections such as the Nikon Integrated Coating, a uniformly sharp image, much superior in resolution, contrast and color rendition is achieved over 100% of the effective, even, super-wide field of view, for observation as well as color photomicrography.

1. Objectives

Mechanical tube length of 160mm and parfocal distance of 45mm (This is longer than the 33.6mm of earlier microscopes). **In every case use the CF objectives in combination with the CF eyepieces.**

1) Types of objective

(1) Achromat (CF)

In this type of objective, the correction of chromatic aberrations is based on the lines C (red) and F (blue). Importance being given to the correction at the center of viewfield, the objectives offer the finest definition and highest contrast of image at the center. Even the 40× and 100× objectives fulfill the "Chromatic Aberration Free" correction, which has been considered difficult so far until now for such high magnifying powers. Furthermore, image flatness has been attained to an appreciable extent.

(2) Plan Achromat (CF Plan)

Same as the above type, the objectives accomplish the correction of chromatic aberrations based on the lines C and F.

In addition, owing to sufficient correction of all the image defects up to the periphery of viewfield, the objectives provide an unsurpassable high resolution and contrast of image over a wider field.

Focusing at the center means simultaneous focusing at the marginal part of viewfield. They are excellent for ultra-wide observation and photomicrography.

(3) Plan Apochromat (CF Plan Apo)

The use of fluorite and special, low color dispersion optical glasses improves the correction of chromatic aberrations over the entire visible region up to the line g (violet) along with the lines C and F.

These highest-grade objectives with their large numerical apertures produce an ideal image over a wide viewfield. With their outstanding definition, superior color reproducibility, and prominent image flatness, they are especially suited for most profound study of minute structures and color photomicrography.

(4) Epi-fluorescence (CF UV-F)

Exclusively designed for episcopic, fluorescence observation, this type objectives use non-fluorescent and non-solarisation materials and a strictly chosen cementing agent, to increase the transmission of UV exciting light (ultra-violet rays). Special weight being attached to the correction at the center of viewfield, and the numerical apertures made extremely large, they ensure bright and sharp fluorescence images using every excitation method. As immersion fluid, the objectives 10×～100× of this type require the use of non-fluorescent glycerine of high purity.

2) Use of the objective

(1) "Oil immersion objectives (Oil)

The objectives discriminated by the engraving "Oil" are to be **immersed in oil between the specimen and front of the objective.**

When using oil immersion objectives of numerical aperture 1.0 or higher, it is recommended, for making full use of its efficiency, to **use a highclass oil-immersion condenser such as of Achromat/aplanat type, applying oil between the glass slide and condenser as well.**

To see if air bubbles are present in the immersion oil, which deteriorate the image quality, pull out the eyepiece from the eyepiece tube to examine the objective exit pupil inside the tube.

To remove air bubbles, revolve the nosepiece slightly to and fro several times, apply additional oil, or replace the oil.

Be careful not to rotate the nosepiece too far as to soil the ends of the other objectives with oil.

To clean off the oil, pass lens tissue or soft cloth moistened with xylene lightly two or three times over the lens. It is essential at this time to avoid touching the lens with the part of tissue or cloth once used.

Any remnants of oil left on the lens deteriorate the image quality.

(2) Coverglass

With the objectives engraved "160/0.17", use a coverglass of 0.17mm in thickness (No. 1½). For the objectives whose N.A. is 0.75 or higher, a coverglass of other thickness than 0.17mm will deteriorate the image definition and contrast.

The indication 160/— on the objective means that no matter whether a coverglass is used or not, no decrease of image definition or of contrast will result.

(3) Objectives with compensation ring

When a high power, dry objective of large N.A. is adopted in combination with a coverglass of thickness other than 0.17mm, which will cause sharp reduction of image definition and contrast, it is necessary to use an objective incorporating a compensation ring as below:

First, observe with the compensation ring set to 0.17, and then rotating the ring, focus the image with the fine focus knob, until an image of the highest sharpness and contrast is obtained.

(4) No-coverglass objectives (NCG)

Objectives with the indication NCG are suited for observing specimens such as smears without coverglass.

(5) Objectives with aperture diaphragm

The objective incorporating an iris diaphragm serves to cut off direct light in darkfield microscopy. Stop down the diaphragm nearly to its minimum opening.

2. Eyepieces

To take full advantage of the CF eyepieces, use them in combination with the CF objectives. The indication "CF" should serve to prevent their use with other type objectives.

1) CFD eyepieces (CFD)

Being of wide field and high eyepoint type, the CFD eyepieces are only used for observation, obtains prominent image flatness. Compared with the CFW eyepieces, they accomplish the good correction of chromatic aberrations at the periphery of the viewfield in combination with the low magnifying power of CF Plan Apochromat objectives.

They are equipped with a diopter ring and a rubber eyeguard. An eyepiece CFD 10×M, incorporating a photo mask, is also available, which enables focusing and framing by the use of the observation tube of the Trinocular Eyepiece Tube "T".

2) CFW eyepieces (CFW)

Being of wide field and high eyepoint type, the CFW eyepieces with diopter ring are only used for observation. They are equipped with a rubber eyeguard.

An eyepiece called CFW 10×M, incorporating a photo mask is also available, which enables focusing and framing by the use of the observation tube of the Trinocular Eyepiece Tube "T".

3) CFUW eyepiece (CFUW)

Featuring extra-wide field of view and high eyepoint, this eyepiece with diopter ring is designed exclusively for observation. It enables observation over a field of view twice as large as that of the ordinary type eyepieces in combination with the ultra-wide tube.

An eyepiece called CFUW 10×M, incorporating a photo mask, is also available, which enables focusing and framing by the use of the observation tube of the Ultra Wide Eyepiece Tube "UW".

4) CF PL Projection lenses (CF PL)

Exclusively designed for photomicrography. Do not use them for observation.

Every eyepiece is liable to gather dirt and dust, which not only appear as shadows but also impair image quality and contrast.

Keep the eyepieces clean at all times.

3. Condensers

1) Abbe condenser

N.A. = 1.25. This is used with 4X ~ 100X objectives. The graduation of this condenser indicates the diameters in mm of the aperture diaphragm opening.

2) Swing-out Achromat condenser

N.A. = 0.9. Dry system.

It is used in combination with objectives from 2X to 100X, and provided with a swing-out top lens which is to be swung out when using the 2X or 4X objective. Its adjustable aperture scale is graduated in N.A. ratings.

3) Achromat/aplanat condenser

N.A. = 1.35. Oil system.

The spherical, coma and chromatic aberrations being ideally corrected, this large aperture condenser is used with 20X ~ 100X objectives. The standard thickness of glass slide should be 1.2mm.

Apply oil between the condenser and glass slide.

It is recommended that this condenser be employed especially in combination with the Plan Apochromat objectives. When using the 100X objective for observation in combination with the CFW 10X eyepiece, it is possible to close the field diaphragm down to 45% of the viewfield.

4) Darkfield condenser (Oil)

N.A. = 1.43 ~ 1.20. Oil system. Used in darkfield microscopy. Apply oil between the condenser and glass slide. (It is recommended to use a thinner glass slide.)

This condenser is used in combination with the objectives 10X ~ 100X with aperture diaphragm (N.A.: up to 1.1).

5) Darkfield condenser (Dry)

N.A. = 0.95 ~ 0.8. Dry system. Used in darkfield microscopy. Magnifying powers of usable objectives are 10X ~ 40X (N.A.: up to 0.7).

4. Illumination System (Fig. 15)

The optical system for illumination in the LABOPHOT microscope is constructed to fulfill the Koehler illumination requirements perfectly, and offers a bright, uniform field without any change-over manipulation.

As a standard light source, use the Halogen lamp 6V 20W (PHILIPS 7388).

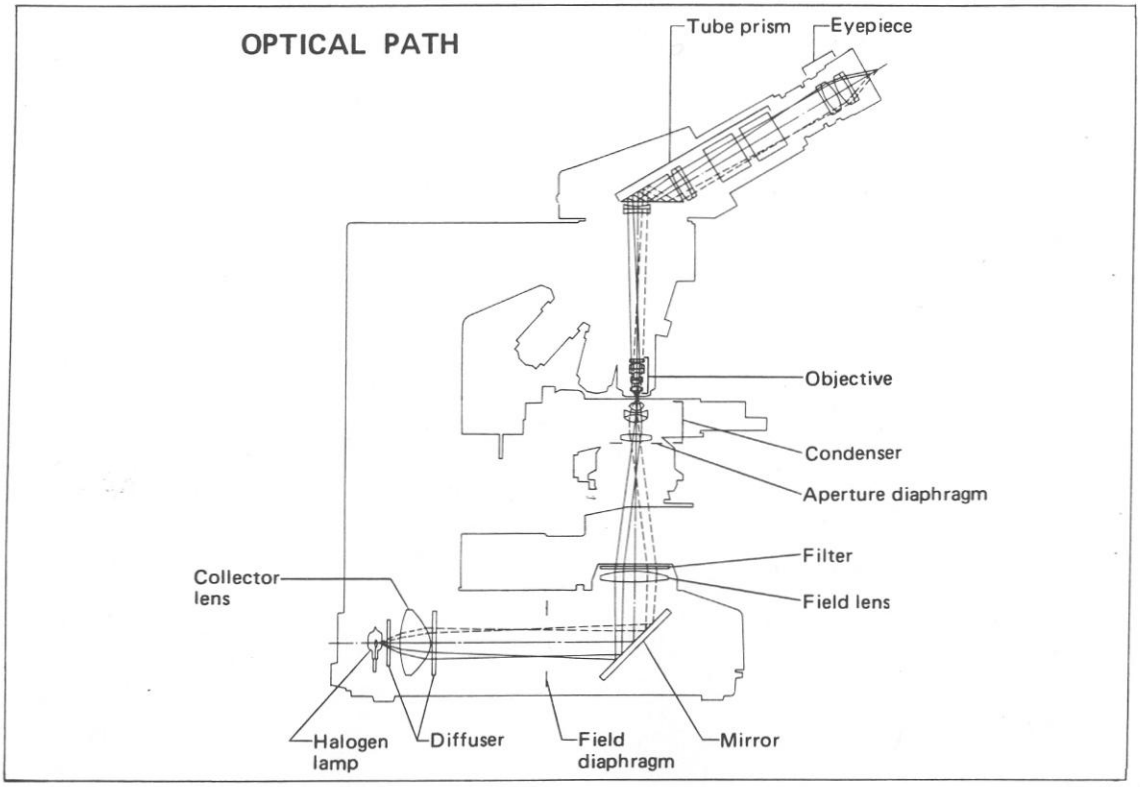


Fig. 15

5. Combinations of Objectives and Eyepieces

Table 2

CF Objectives (160/45) for Biological Microscope							CF Eyepieces											
							Ordinary viewfield									Ultra-Wide viewfield		
							CFW8× Field number=18			CFW 10× Field number=18			CFW 15× Field number=14			CFUW 10× Field number=26.5		
Type	Magnification	Numerical aperture N.A.	Working distance W.D.mm	Focusing distance fmm	Resolving power μm	Coverglass thickness mm	Total magnification M	Real viewfield ø mm	Depth of focus μm	Total magnification M	Real viewfield ø mm	Depth of focus μm	Total magnification M	Real viewfield ø mm	Depth of focus μm	Total magnification M	Real viewfield ø mm	Depth of focus μm
Plan Apochromat	2×	0.08	5.3	67.9	3.4	—	16×	9.0	155	20×	9.0	132	30×	7.0	102	20×	13.3	132
	4×	0.16	4.73	36.1	1.7	0.17	32×	4.5	39	40×	4.5	33	60×	3.5	26	40×	6.6	33
	10×	0.4	0.33	14.2	0.69	0.17	80×	1.8	6.2	100×	1.8	5.3	150×	1.4	4.1	100×	2.7	5.3
	With compensation ring 20×	0.65	0.5	7.9	0.42	0.17	160×	0.9	2.0	200×	0.9	1.8	300×	0.7	1.4	200×	1.3	1.8
	With compensation ring 40×	0.95	0.1	4.2	0.29	0.17 (0.11~0.23)	320×	0.45	0.8	400×	0.45	0.7	600×	0.35	0.6	400×	0.66	0.7
	Oil 40×	1.0	0.1	3.9	0.28	0.17	320×	0.45	1.1	400×	0.45	1.0	600×	0.35	0.8	400×	0.66	1.0
	60×	0.9	0.1	2.9	0.31	0.17 (0.11~0.23)	480×	0.3	0.7	600×	0.3	0.6	900×	0.23	0.5	600×	0.44	0.6
	Oil 100×	1.35	0.17	1.7	0.2	0.17	800×	0.18	0.4	1000×	0.18	0.4	1500×	0.14	0.3	1000×	0.27	0.4
	Oil NCG 100×	1.35	0.17	1.7	0.2	non	800×	0.18	0.4	1000×	0.18	0.4	1500×	0.14	0.3	1000×	0.27	0.4
Plan Achromat	1×	0.03	1.8	108.7	9.2	—	8×	18	900	10×	18	782	15×	14	623	—	—	—
	2×	0.05	5.8	70.1	5.5	—	16×	9.0	289	20×	9.0	253	30×	7.0	205	20×	13.3	253
	4×	0.1	13.8	40.4	2.8	—	32×	4.5	72	40×	4.5	63	60×	3.5	51	40×	6.6	63
	10×	0.25	7.1	16.7	1.1	—	80×	1.8	11.5	100×	1.8	10.1	150×	1.4	8.2	100×	2.7	10.1
	20×	0.4	1.4	8.4	0.69	0.17	160×	0.9	4.0	200×	0.9	3.5	300×	0.7	2.9	200×	1.3	3.5
	40×	0.65	0.48	4.1	0.42	0.17	320×	0.45	1.3	400×	0.45	1.2	600×	0.35	1.0	400×	0.66	1.2
	NCG 40×	0.65	0.45	4.2	0.42	non	320×	0.45	1.3	400×	0.45	1.2	600×	0.35	1.0	400×	0.66	1.2
	Oil 50×	0.85	0.34	3.2	0.32	0.17	400×	0.36	1.2	500×	0.36	1.1	750×	0.28	0.9	500×	0.53	1.1
	NCG 60×	0.85	0.35	2.8	0.32	non	480×	0.3	0.7	600×	0.3	0.7	900×	0.23	0.6	600×	0.44	0.7
	With compensation ring 60×	0.85	0.43	2.6	0.32	0.17 (0.11~0.23)	480×	0.3	0.7	600×	0.3	0.7	900×	0.23	0.6	600×	0.44	0.7
	100×	0.9	0.1	1.7	0.31	0.17	800×	0.18	0.5	1000×	0.18	0.5	1500×	0.14	0.4	1000×	0.27	0.5
	NCG 100×	0.9	0.26	1.6	0.31	non	800×	0.18	0.5	1000×	0.18	0.5	1500×	0.14	0.4	1000×	0.27	0.5
	Oil 100×	1.25	0.2	1.8	0.22	0.17	800×	0.18	0.5	1000×	0.18	0.4	1500×	0.14	0.4	1000×	0.27	0.4
Achromat	4×	0.1	20	31.0	2.8	—	32×	4.5	72	40×	4.5	63	60×	3.5	51			
	10×	0.25	5.6	16.6	1.1	—	80×	1.8	11.5	100×	1.8	10.1	150×	1.4	8.2			
	20×	0.4	2.23	8.8	0.69	0.17	160×	0.9	4.0	200×	0.9	3.5	300×	0.7	2.9			
	With compensation ring 20×	0.4	2.2	8.8	0.69	0.17 (0~2.0)	160×	0.9	4.0	200×	0.9	3.5	300×	0.7	2.9			
	40×	0.65	0.53	4.4	0.42	0.17	320×	0.45	1.3	400×	0.45	1.2	600×	0.35	1.0			
	LWD With compensation ring 40×	0.55	1.3	4.0	0.5	1.0 (0~2.0)	320×	0.45	1.7	400×	0.45	1.6	600×	0.35	1.3			
	Oil 100×	1.25	0.14	1.8	0.22	0.17	800×	0.18	0.5	1000×	0.18	0.4	1500×	0.14	0.4			
	With aperture diaphragm 100×	1.25	0.14	1.8	0.22	0.17	800×	0.18	0.5	1000×	0.18	0.4	1500×	0.14	0.4			
Epi-fluorescence UV-F	10×	0.5	0.9	14.3	0.55	0.17	80×	1.8	4.7	100×	1.8	4.0	150×	1.4	3.0			
	Glycerin 10×	0.5	0.28	16.2	0.55	0.17	80×	1.8	6.9	100×	1.8	5.8	150×	1.4	4.4			
	20×	0.75	0.66	7.8	0.37	0.17	160×	0.9	1.7	200×	0.9	1.4	300×	0.7	1.1			
	Glycerin 20×	0.8	0.2	8.9	0.34	0.17	160×	0.9	2.3	200×	0.9	2.0	300×	0.7	1.5			
	40×	0.85	0.37	4.2	0.32	0.17	320×	0.45	0.9	400×	0.45	0.8	600×	0.35	0.7			
	Glycerin 40×	1.3	0.1	4.5	0.21	0.17	320×	0.45	0.8	400×	0.45	0.6	600×	0.35	0.5			
	Glycerin 100×	1.3	0.13	1.7	0.21	0.17	800×	0.18	0.4	1000×	0.18	0.4	1500×	0.14	0.3			

Resolving power: $\frac{\lambda}{2\times N.A.}$

(λ = 0.55 μm standard wavelength)

Depth of focus:

$$\frac{n\times\lambda}{2\times(N.A.)^2}+\frac{n}{7\times N.A.\times M}$$

(Resolving power of eye=2'
n:Refractive index of object side)

V. PHOTOMICROGRAPHY

(The Biological Microscope LABOPHOT is designed mainly for observation.)

1. Combination of CF Objectives and CF PL Projection lens

The combined use of the CF objectives and CF PL Projection lens is essential.

For the same total magnification, select a combination of the highest possible objective power and lowest possible projection lens power to achieve the utmost image definition and contrast.

2. Checking the Illumination

Uneveness in the illumination will show up more conspicuously in photomicrography than in observation. Consequently, before taking a photograph, recheck the correct adjustment of the condenser.

3. Selection of Voltage and Filter

1) When using a daylight type color film

Set the brightness control dial to 5.5 and use the NCB10 filter※.

Adjustment of the image brightness should be made by means of the ND filters.

2) When using a monochrome film

Remove the NCB 10 filter. Contrast filters such as X-1 green are usable.

※ The NCB 10 filter is most suitable for a standard film. Depending upon the make of the film different color renditions may result. It is recommended that in addition to the NCB 10 filter a color compensation filter (CC filter), available from the film manufacturer, be used.

4. Shutter Speed

Desirable shutter speeds for least vibration are 1/4 ~ 1/15 sec.

Adjustment of the image brightness for color photomicrography should be made by means of the ND filters. Some specimens require, on account of their insufficient brightness, longer exposure times, and consequently poor color reproducibility owing to the "Reciprocity Law Failure" of film may result. So, when taking picture of such specimens, it is recommended to use the Nikon Biological microscope OPTIPHOT.

5. Manipulation of Field and Aperture Diaphragms

In photomicrography, the adjustment of the field diaphragm is important for the purpose of limiting extraneous light which causes flare in the microscope image. Stop down the diaphragm so as to get an illuminated area slightly larger than that of the picture field. By adjusting the aperture diaphragm, a change of depth of focus, contrast and resolution of image is attainable. Select a size suited to the purpose. Generally speaking, the aperture diaphragm, is properly stopped down to 70 ~ 80% of the aperture of the objective being used.

6. With Regard to Condensers

For photomicrography, it is generally recommended to use the Swing-out Achromat condenser. When using 2× objective, however, preferably remove the condenser.

7. Focusing

Focusing is to be accomplished by means of the ocular finder on the photomicrographic attachment, or binocular observation tube with mask eyepiece on the trinocular eyepiece tube.

Table 3. Focusing

Type of eyepiece tube	Focusing with 10× or higher objective	Focusing with 4× or lower objective
"F" tube	Use Ocular finder	Use Ocular finder + Focusing magnifier
"T" or "UW" tube	Use observation tube	Use observation tube or Ocular finder + Focusing magnifier

① Adjust diopter.

- **Binocular of eyepiece tube:**
  Use 4× or 10× objective.
  Insert the mask eyepiece into either of right or left eyepiece sleeve that is accustomed to usual use. Adjust the diopter ring to bring the double cross line in the view field center into focus. (Fig. 16)
  Then focus the specimen image also on the central area of the mask by means of the focus knob of the microscope.
  The diopter of another eyepiece is to be adjusted by focusing specimen rotating the diopter ring without using the microscope focus knob.
  Rotate the mask eyepiece so as the mask positions as shown in Fig. 19.

- **Ocular finder:**
  Adjust the diopter ring so as the double cross line in the view field center can be seen clear and each line separated. (Fig. 17)

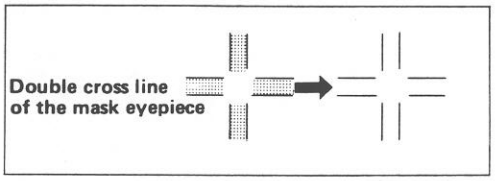


Fig. 16

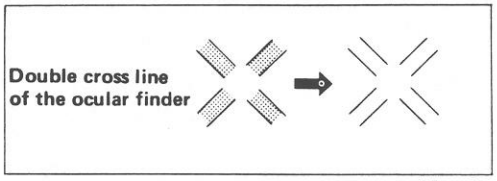


Fig. 17

② Make focusing according to the magnification of objective to be used.

- **Using 40× or higher objective:**
  With diopter adjusted eyepiece make the specimen image sharp by rotating the microscope fine focus knob and make sure that both of the double cross line and the specimen image are seen crisply at the same time.

- **Using medium magnification objective 10×, 20×, etc.:**
  After focusing the same way as above, bring the specimen image to coincide with the double cross line so as their relative position is fixed and unchaned under observation by swinging your eye laterally. (Focusing by parallax method.)

- **Using 4× or lower objective:**
  Attach the focusing magnifier to the ocular finder. (Fig. 18)

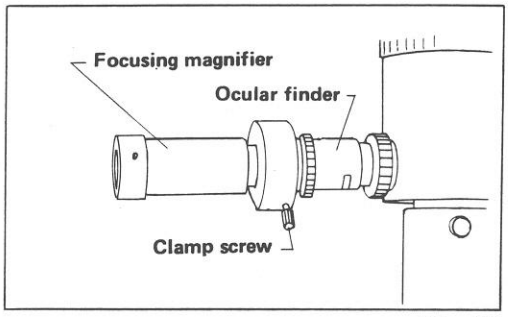


Fig. 18

Viewing through the attached focusing magnifier, move it back and forth until the double cross line is seen clear. Then, focus the double cross line and the specimen image by rotating the fine focus knob as sharp as possible.

8. Picture composing

Compose the picture within the mask in the ocular finder corresponding to the film size in use by driving the microscope stage by lateral and longitudinal movement and rotation. (Fig. 19)

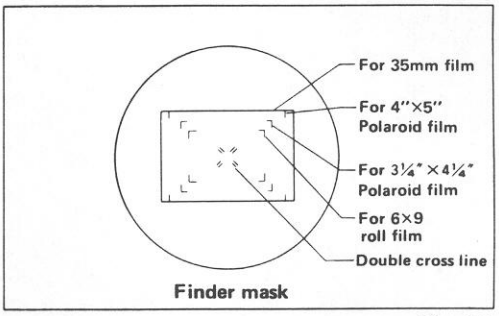
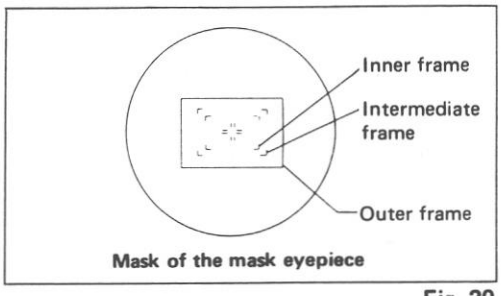


Fig.19

When the mask eyepiece is used, select one out of masks in the view field suitable to the film size relative to CF PL Projection lens in use, in reference with Fig. 20 and Table 4.



Mask of the mask eyepiece

Fig. 20

Table 4

Mask	CF PL Projection lens	Film size				
		35 mm	6×9 cm	3¼"×4¼"	4" × 5"	6×6 cm
Inner frame	2.5×	–	–	–	–	–
	4×	–	–	◎	–	–
	5×	◎	–	–	◎	–
Inter-mediate frame	2.5×	–	◎	◎	–	–
	4×	◎	–	–	◎	–
	5×	–	–	–	–	–
Outer frame	2.5×	◎	–	–	◎	–
	4×	–	–	–	–	–
	5×	–	–	–	–	–

Note: Framing for picture composing will be more accurate by the ocular finder than the mask eyepiece.

9. Vibration-free operation

Set the microscope on a vibration-resistant, rigid desk or a bench with a vibration-proof device.

10. Others

- When using the 1 × objective, place the diffuser (available on order), and remove the condenser.
- For photomicrography, when focusing with the binocular observation tube, use the CF eyepiece, CF PL Projection lens and CF photo mask eyepiece, with the magnification and other indications engraved in yellow, or in white with a white dot in addition.
- For the use of other photomicrographic attachment refer to the pertinent instruction manuals.

VI. USE OF THE ACCESSORIES

1. Ultra Wide Field Trinocular Eyepiece Tube "UW"

1) Objectives

CF Plan Achromat 2X ~ 100X, CF Plan Apochromat 2X ~ 100X, CF Plan Achromat for phase contrast 10X ~ 100X, CF Plan Achromat for metallurgical 5X ~ 100X, CF Plan Apochromat for metallurgical 50X or CF BD Plan Achromat for bright and darkfield 5X ~ 100X are used.

2) Condenser

Refer to the Table 1 (P. 8).

3) Assembly and microscopy

Assembly and microscopy being almost the same as that of the regular microscopy (P. 6 and P. 8), only the differences will be described below.

(1) Using the centering telescope

For attaching the centering telescope on top of the eyepiece sleeve, it is necessary to use the adapter (Fig. 21), because the telescope which has been originally designed for centering the annular diaphragm in phase contrast microscopy, has a fitting diameter different from that of the CFUW eyepiece.

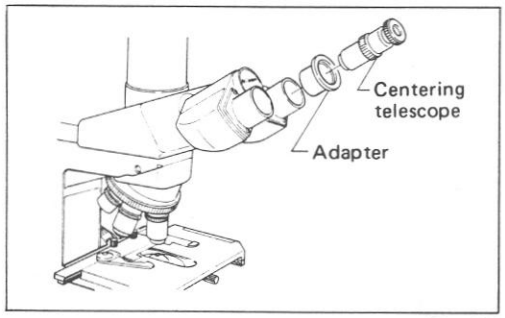


Fig. 21

2. Polarizing Filter Set "PT"

1) Nomenclature (Fig. 22)

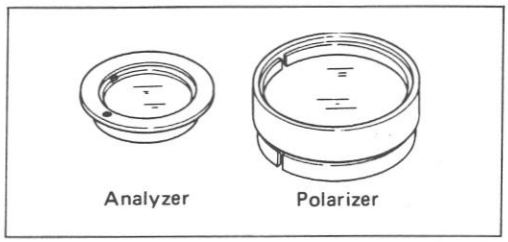


Fig. 22

2) Assembly

(1) Attaching the analyzer

After removing the eyepiece tube, insert the analyzer into the optical path hole in the microscope arm. (Fig. 23)

The white index dot is to be brought into coincidence with the Y-axis (of X-Y co-ordinates), viewing the arm from above.

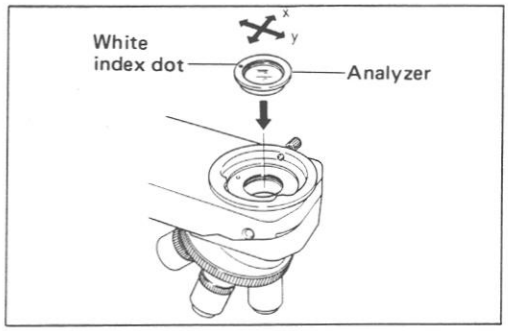


Fig. 23

(2) Condenser

Use the Swing-out condenser.

(3) Attaching the polarizer

As shown in Fig. 24, fit the polarizer to the internal diameter at the bottom of the condenser.

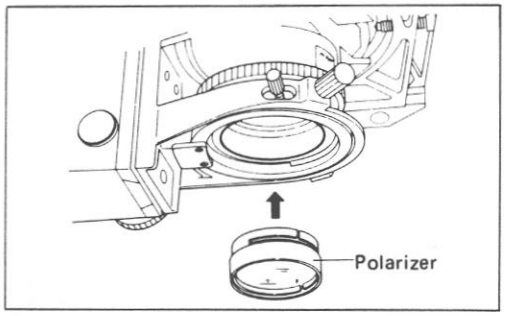


Fig. 24

(4) Objective
Use the ordinary CF objectives.

3) Microscopy

(1) Turn ON the power switch. Set the brightness control dial to 4.
(2) Remove the dust cap and place the daylight filter.
(3) Place the specimen on the stage and focus on specimen with 10× objective.
(4) Adjust the interpupillary distance and diopter. (Refer to P. 9)
(5) Swing in the top lens of the swing-out condenser in the optical path. (If using 4× objective swing out the top lens.)
(6) Center the condenser. (Refer to P. 10)
(7) Rotate the polarizer until the darkest field of view is obtained.
(8) Set the brightness control dial to 5 ~ 6.
(9) Change over the objective to be used and sharpen the focus on the specimen.
(10) Adjust the aperture diaphragm and field diaphragm. (Refer to P. 10 and 11)

(NOTE)
The following accessories can not be used in combination with LABOPHOT (Y-R stand) Microscope.

- Teaching Head and Multi-teaching Head (Only when they are combined with Ultra Wide Eyepiece Tube "UW")
- Epi-illuminator "M"

Ⅶ. TROUBLE SHOOTING TABLE

Although nowhere the user can find any disorder or derangement in the instrument, if he encountes some difficulty or dissatisfaction, recheck the use, referring to the table below:

1. Optical

Failures	Causes → Actions
Darkness at the periphery or uneven brightness of viewfield (No appearance of viewfield)	• Optical path in trinocular tube not fully changed-over → Changing-over to the limit (Refer to P. 9) • Revolving nosepiece not in click-stop position (Objective not centered in optical path) → Revolve it to click-stop position • Condenser not centered → Centering by using field diaphragm (Refer to P. 10) • Field diaphragm too much closed → Open it properly • Dirt or dust on the lens (Condenser, objective, eyepiece, slide) → Cleaning • Improper use of condenser → Correct use (Refer to P. 10)
Dirt or dust in the viewfield	• Dirt or dust on the lens (Condenser, objective, eyepiece, field lens) → Cleaning • Dirt or dust on the slide → Cleaning • Too low position of condenser → Correct positioning (Refer to P. 10)
No good image obtained (low resolution or contrast)	• No coverglass attached to slide or NCG objective used with coverglass → Correct use (Refer to P. 13) • Too thick or thin coverglass → Use specified thickness (0.17mm) coverglass (Refer to P. 13) • Immersion oil soils the top of dry system objective (especially 40X) → Cleaning • Dirt or dust on the lens (Condenser, objective, eyepiece, slide) → Cleaning • No immersion oil used on immersion system objective → Use immersion oil (Refer to P. 12) • Air bubbles in immersion oil → Remove bubbles • Not specified immersion oil used → Use Nikon immersion oil • Condenser aperture and field diaphragm too much opened → Close properly (Refer to P.10, 11) • Dirt or dust on the entrance lens → Cleaning • Compensation ring in objective not adjusted → Adjustment (Refer to P. 13) • Objective aperture (which provided) too much closed → Open properly
Image quality deteriorated	• Condenser aperture too much closed → Open properly (Refer to P. 10) • Too low position of condenser → Bring it up to coincidence with field diaphragm image (Refer to P. 10)
Oneside dimness of image	• Revolving nosepiece not in click-stop position → Revolve it to click-stop position

Failures	Causes → Actions
Image moves while being focused	• Specimen rises from stage surface → Place it stable • Revolving nosepiece not in click-stop position → Revolve it to click-stop position • Condenser not correctly centered → Correct centering (Refer to P.10) • Optical path in trinocular tube not fully changed-over → Changing-over to the limit (Refer to P. 9)
Image tinged yellow	• Daylight filter not used → Use daylight filter

2. Manipulation

Failures	Causes → Actions
No focused image obtained with high power objectives	• Upside down of slide → Turn over the slide • Too thick coverglass → Use specified thickness (0.17mm) coverglass (Refer to P. 13)
High power objective touches the slide, when changed-over from low power	• Upside down of slide → Turn over the slide • Too thick coverglass → Use specified thickness (0.17mm) coverglass (Refer to P. 13) • Eyepiece diopter not adjusted (Especially when changing-over low power objective 1× or 2×) → Diopter adjustment (Refer to P. 9)
Insufficient parfocality of objective (when changed-over)	• Eyepiece diopter not adjusted → Diopter adjustment (Refer to P. 9)
Movement of image not smooth by moving the slide	• Slide holder not tightly fixed → Fix it tightly
Travel of stage limited to one half length of slide	• Improper attaching of slide holder → Shift the attaching position
No fusion of binocular images	• Interpupillary distance not adjusted → Adjustment (Refer to P. 9)
Fatigue of observing eyes	• Incorrect diopter adjustment → Correct adjustment (Refer to P.9) • Inadequate brightness of illumination → Change power voltage

3. Electrical

Failures	Causes → Actions
Lamp does not light even though switched ON	• No electricity obtained → Connect the cord to socket • No lamp bulb attached → Attaching • Lamp bulb blown → Replacement • Fuse blown → Replacement
Unstable brightness of illumination	• Input voltage not adjusted to house current voltage (for European districts only) → Turn the change-over switch on the microscope bottom • House current voltage fluctuates too much → Use transformer or the like (for adequate voltage)
Lamp bulb promptly blown	• Not specified lamp bulb used → Use 6V 20W specified lamp bulb: (Halogen bulb: PHILIPS 7388) • Too high voltage of house current → Use transformer for adjustment
Insufficient brightness of illumination	• Condenser not centered → Centering (Refer to P. 10) • Condenser aperture too much closed → Open it properly (Refer to P. 10) • Too low position of condenser → Correct positioning (Refer to P. 10) • Not specified lamp bulb used → Use 6V 20W specified Halogen bulb (PHILIPS 7388) • Dirt or dust on lens (condenser, objective, eyepiece, field lens, filter) → Cleaning • Too low voltage → Raise the voltage
Fuse blown	• Not specified fuse used → Use 1A (250V) or 0.5A (250V)
Flickering or unstable brightness of lamp bulb	• Lamp bulb going to be blown → Replacement • Lamp bulb not inserted to the limit → Secure connection • Fuse holder not firmly fastened → Firm fastening • Irregular change of house current voltage → Use stabilizer • Lamp bulb insufficiently inserted into the socket → Positive connection

4. Photomicrography

Failures	Causes → Actions
No sharp picture obtained	• Improper focusing → • Viewing into the finder and turning diopter ring, bring double crosshair into focus. Moving the eye laterally, rotate fine focus knob, until no parallax separation appears between the image and double crosshair. • At lower magnifications use focusing telescope in addition.

Failures	Causes ⟶	Actions
No sharp picture obtained	• Out of focus (Especially with high power objective and long-exposure)	• For preventing external vibration, use vibration-proof table or rigid desk. • Select a place free from vibrations, such as caused by traffic, passers-by or motors etc.
	• Momentary vibration	• Using ND filters or others, elongate exposure time (for color film, to 1/4 ~ 1/15 sec.) • Lower the voltage, and elongate exposure time (for black-and-white film). Note, however, for color film, that lowering of color temperature and change of spectral characteristics will be unavoidable.
	• Incorrect thickness of coverglass (Especially, when using large N.A. and high power objective)	• Use a standard coverglass of 0.17mm in thickness. (No. 1 ½) • Use objective with coverglass thickness compensation ring.
	• Using dry objectives for smear preparations	• Use no-coverglass type objective. • If other objectives are to be used, place a coverglass on the specimen.
Fogging of image	• Grease, dust or dirt on optical surfaces	• Clean the front of objective thoroughly, top surface of projection lens, specimen, photographic lens, condenser lens, field lens, etc.
Illuminated image not uniformly	• Condenser not centered (This shows up more conspicuously in photography than in observation)	• Centering (Refer to P. 10)
Insufficient image contrast	• Aperture diaphragm opened too large	• Generally, good results will be achieved with aperture stopped down to 70 ~ 80% of N.A. of the objective being used. (Refer to P. 10)
	• Incorrect use of filter	• In metallurgical, interference, polarizing or phase contrast microscopy, use of a green filter or monochromatic interference filter (e.g. peak wavelength = 546nm, half-value range = 30 nm) will increase contrast. • When contrast is to be increased for a part stained with a particular color, use a filter whose color is complementary to the stain color (for black-and-white film).
	• Inadequate use of field diaphragm	• Stop down field diaphragm to a diameter slightly larger than the diagonal of picture frame. (Refer to P. 16)

Failures	Causes ——→	Actions
Insufficient image contrast	● Low contrast in specimen ——→	● To increase contrast optically, select phase contrast, darkfield, or differential interference methods. ● Specimens should be stained a rather dark color, if possible. ● In color photography, depending upon the specimen, red-blue separation staining (Mallory or Azan methods etc.) is preferable to red-violet combination staining (H-E staining). ● In black-and-white photography, for low contrast specimens a film of finer grain and higher contrast is more suited (such as minicopy film). ● For general specimens a film of wider latitude and finer grain is preferable.
Deficient resolving power of microscope	● Insufficient N.A. of objective ——→ ● Excessive magnification ——→	● Use a large N.A. objective. ● For the same magnification, increase power of objective rather than that of eyepiece to attain higher resolution and sharpness, even though depth of field is reduced. ● 500 ~ 1000 times N.A. are magnification limits for resolving power.
Ghosts or flare appears	● Extraneous light entering the ocular finder ——→ ● Stray light entering ——→	● Darken the surroundings or place the cap on the ocular finder. ● Take care not to expose microscope and specimen to direct sunlight and other intense lights.
Poor photograph obtained	● Inadequate use of filter ——→ ● Film of another make or emulsion NO. ——→ ● Wrong power source voltage used ——→ ● Incorrect exposure time ——→ ● Influenced by film development ——→	● Select best filter combination. ● Note that, when using a daylight film, remarkably different spectral sensitivities will result depending upon the type, make, etc. ● Even though of same make, according to emulsion number, different color rendition will be obtained. ● Take picture in every case at the specified voltage. (Refer to P. 16) ● By inadequate exposure time, color rendition will not be true on account of "reciprocity law failure" Then, with the help of exposure time indicator, adjust exposure time according to characteristics of film by means of ND filters, or compensate for such failure by means of CC filters. (Refer to Kodak Data) ● Especially, for making color prints, it is recommended to contact the development laboratory.

ELECTRIC SPECIFICATIONS

Power source	100V 120V 50/60 Hz 220/240V
Halogen lamp	6V 20W (PHILIPS 7388)
Fuse	100V, 120V } 1A (250V) 220/240V 0.5A (250V)

We reserve the right to make such alterations in design as we may consider necessary in the light of experience. For this reason, particulars and illustrations in this handbook may not conform in every detail to models in current production.

Nikon

NIPPON KOGAKU K.K.

Fuji Bldg., 2-3, 3 chome, Marunouchi,
Chiyoda-ku, Tokyo 100, Japan
☎03-214-5311
Telex: J22601 (NIKON)

Printed in Japan

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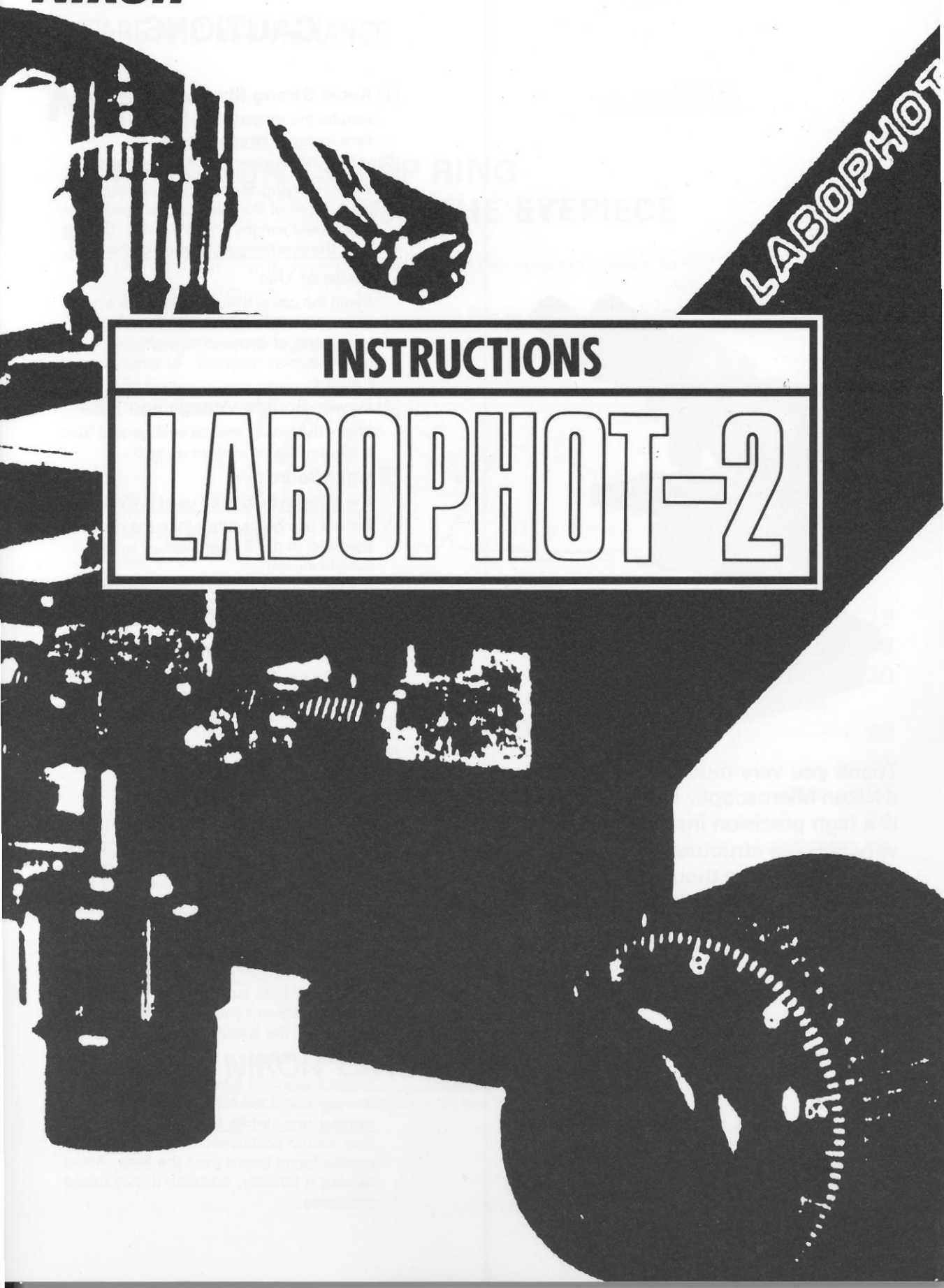
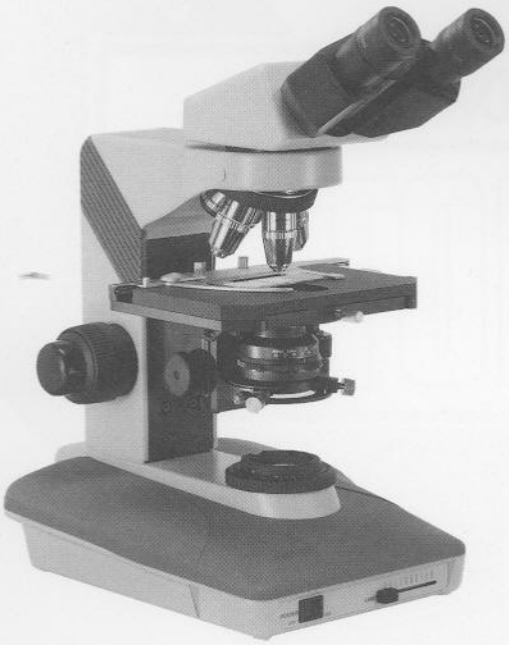
Nikon



INSTRUCTIONS

LABOPHOT-2



Thank you very much for purchasing a Nikon Microscope. This microscope is a high precision instrument with a very delicate structure and varied functions. Please thoroughly read this manual first to use the microscope correctly.

CAUTIONS

1 Avoid Strong Shocks!

Handle the microscope gently, taking care to avoid strong shocks.

2 When Carrying the Microscope

When carrying the microscope, support the bottom of the microscope base. The instrument weighs about 7.9 kg. Do not hold the overhanging portion of the base.

3 Place of Use

Avoid the use of the microscope in a dusty place, or where it may be subject to Vibrations, or exposed to high temperatures, moisture, or direct sunlight.

4 Power Source Voltage and Fuse

Check the power source voltage and fuse following the procedure on p.6.

5 Light Source

The halogen bulb to be used is 6V-30W.

Do not use bulbs other than the one specified in p.29 (electrical specifications).
If a bulb of more than the suggested wattage is used, the light adjusting circuit may be damaged.

6 Turning on the Lamp

Take care not to touch the lamp housing when it is lit, and don't bring inflammable substances such as gasoline, thinner and alcohol near it, as some parts of the lamp housing may become very hot while the lamp is on.

7 Changing the Bulb and Fuse

Before replacing the bulb or fuse, turn OFF the main switch and disconnect the power source plug. Replace the halogen lamp (6V-30W), making sure that it is cool enough. Do not touch the glass part with your bare hands.

8 Dirt on the Lens

Do not leave dust, dirt, or finger marks on the lens or bulb surfaces.
They will prevent you from clearly observing the specimen.

9 Focus Knobs

Never attempt to adjust the tightness of the right-and left-hand focus knobs by turning one, while holding the other. It may cause problems. Do not turn the coarse focus knobs past the limit. Avoid turning it forcibly, because it may cause problems.

CARE AND MAINTENANCE

1 Cleaning the Lenses

To clean the lens surfaces, remove dust using a soft brush or gauze. Only when removing finger marks or grease, use a soft cotton cloth, lens tissue, or gauze lightly moistened with **pure alcohol** (methyl alcohol or ethyl alcohol). **For cleaning the objectives of immersion oil use only xylene.** Do not use xylene for cleaning the surface of the entrance lens of the eyepiece tube or the prism surface of the Ultra-Wide Eyepiece Tube "UW". Observe sufficient caution in handling alcohol and xylene (they are inflammable), and the ON-OFF of the power source switch.

2 Cleaning the Painted Surfaces

Avoid the use of any organic solvent (for example, thinner, ether, alcohol) for cleaning the painted surfaces and plastic parts of the instrument. We recommend you use the silicon cloth.

3 Never Attempt to Dismantle!

Never attempt to dismantle the instrument because you may impair the functions.

4 When Not in Use

When not in use, cover the instrument with the accessory vinyl cover, and **store it in a place free from moisture and fungus.** It is especially recommended that the objectives and eyepieces be kept in an airtight container containing desiccant.

5 Periodic Checking

To maintain the best performance of the instrument, we recommend that the instrument be periodically checked. (For details of this check, contact your authorized Nikon distributor.)

★Please note as per your Nikon warranty, **"Any defects or damage directly or indirectly caused by the use of unauthorized replacement parts and/or performed by unauthorized personnel"** will void the warranty.

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I . NOMENCLATURE

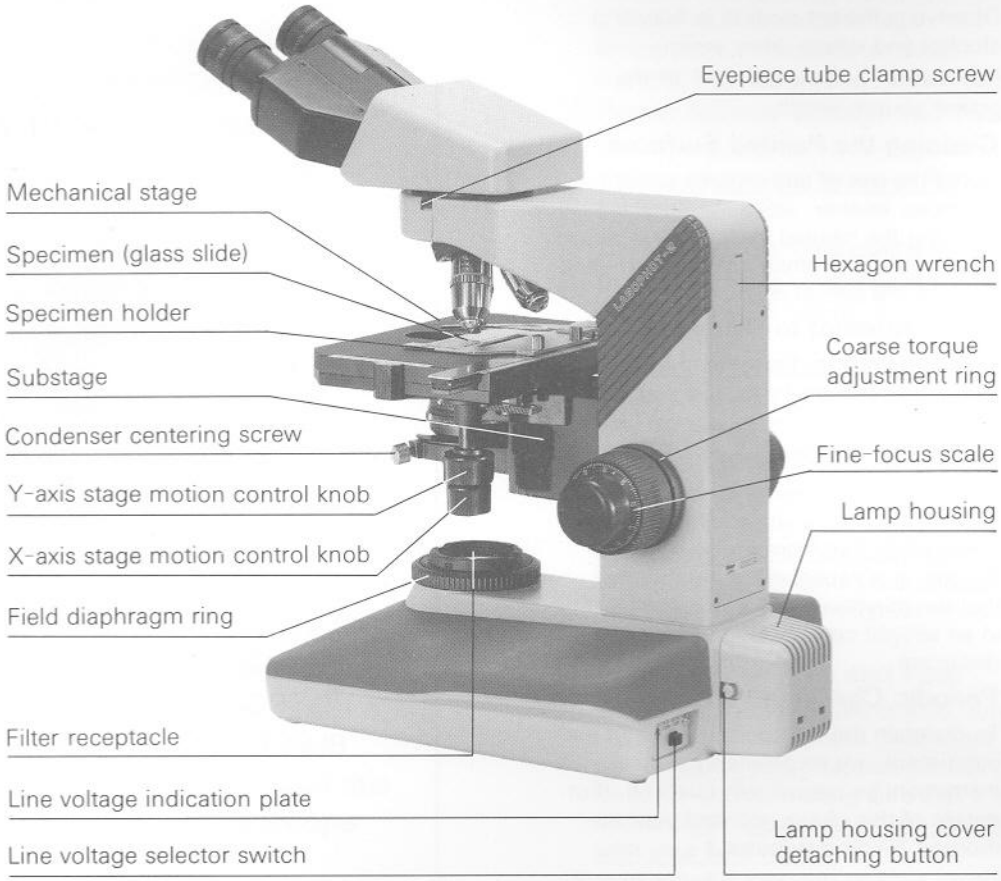


Fig. 1-1

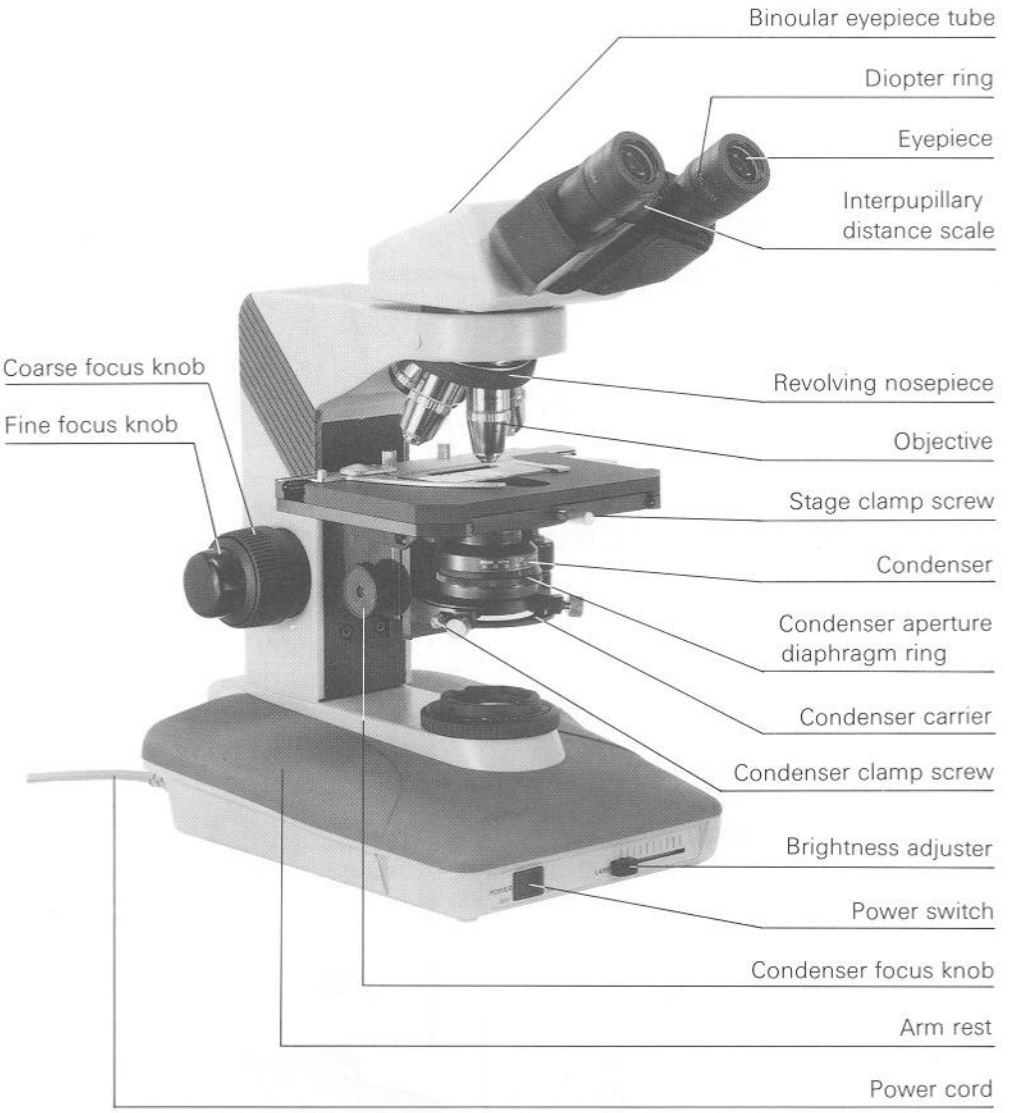

Binoular eyepiece tube
Diopter ring
Eyepiece
Interpupillary distance scale
Coarse focus knob
Fine focus knob
Revolving nosepiece
Objective
Stage clamp screw
Condenser
Condenser aperture diaphragm ring
Condenser carrier
Condenser clamp screw
Brightness adjuster
Power switch
Condenser focus knob
Arm rest
Power cord

Fig. 1-2

II . ASSEMBLY (mounting and dismantling)

To assemble the microscope, follow the procedures given from ① to ⑫.
For details, read p.6 to p.11.

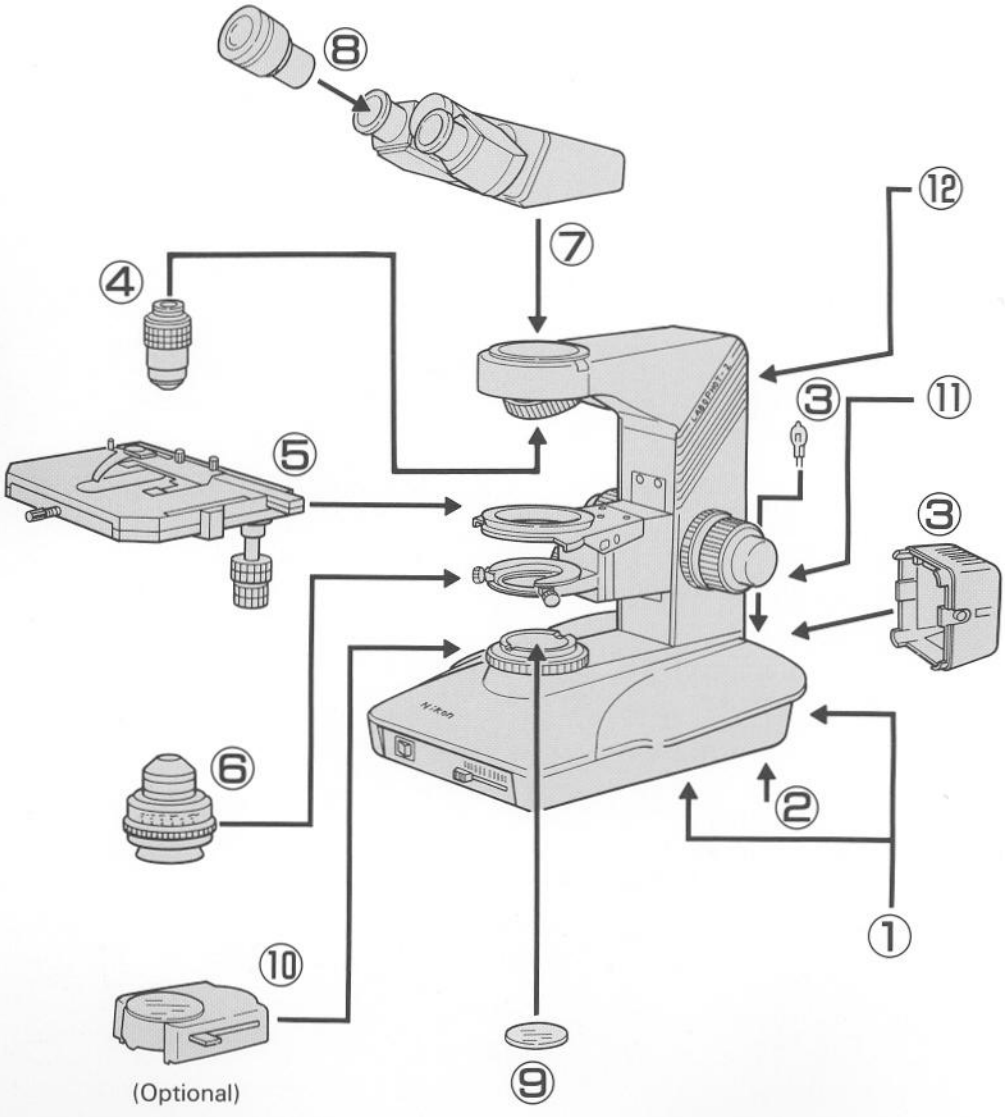


Fig.2

Tools: hexagon wrench (accessory), plus screwdriver, minus screwdriver

① Check the Power Source Voltage and Fuse

- Disconnect the power cord from the AC input connector. (Make sure that it is disconnected.)
- Make sure that the line voltage indication plate at the rear of the base indicates the correct line voltage to be used **(100-120V or 220-240V)** (Fig. 2-1).
  When it indicates incorrect voltage, remove the line voltage indication plate by unscrewing the two screws using a plus screwdriver.
- Mount the line voltage indication plate after switching the input voltage change-over switch to indicate correct voltage.

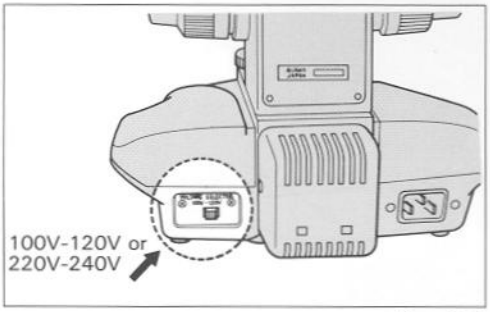


Fig. 2-1

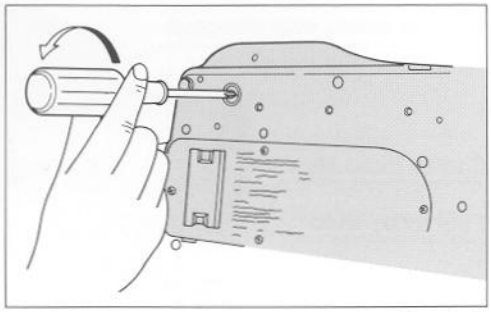


Fig. 2-2

- Remove the fuse holder at the bottom of the base using a plus screwdriver (Fig.2-2) and make sure that the metal part of the fuse indicates **"250V 1A"** for 100-120V or **"250V T1A"** for 220-240V. When incorrect fuse type is to be inserted, please contact your authorized Nikon distributor.
- Insert the fuse into the fuse holder and tightly screw it into the original position using a plus screwdriver.

② Leveling Foot Screw

- For stable installation of the microscope, manipulate the adjustment screw at the rear-right of the base (Fig. 2-3).

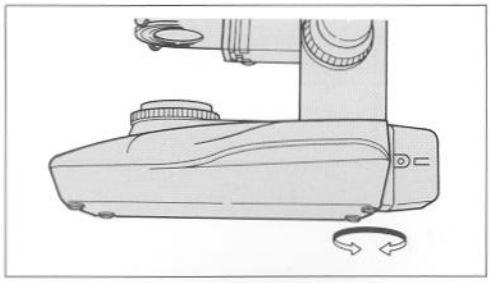


Fig. 2-3

③ Mounting Lamp and Lamp Housing

Keep the cover on or use gloves when mounting the lamp bulb so as not to touch the surface directly with your fingers. If finger marks or dirt on the bulb surface, wipe them off with lens tissue. Make sure to remove the cover after mounting the lamp.

- Remove the lamp housing cover pressing the cover detaching buttons (Fig.2-4).
- Insert the lamp into the socket pin holes until it reaches the limit (Fig.2-5).
- Reattach the cover.

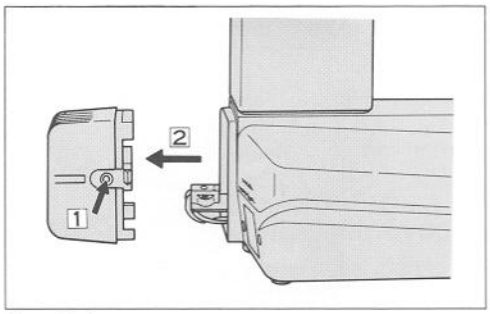


Fig. 2-4

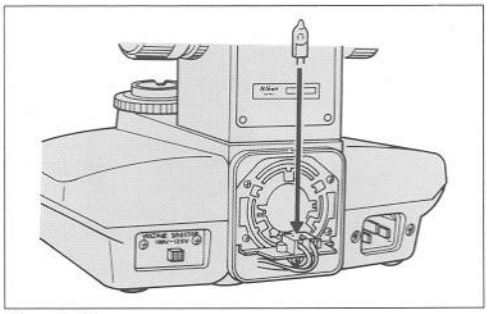


Fig. 2-5

Cautions when dismantling

- Turn off the power switch. (Make sure that it is off.) Do not touch the bulb immediately after turning it off because it is very hot. Make sure that the bulb has cooled enough when replacing it.

④ Mounting and Dismantling the Objectives

- Mount the objectives into the holes of the revolving nosepiece in such positions that, when viewed from above, their magnifying power increases as the nosepiece is revolved clockwise (Fig. 2-6).

Cautions when dismantling

- Remove the ND filter cassette if attached and lower the stage by turning the coarse focus knob.
- Remove any specimen if it is on the stage.
- Hold the objective with both hands so as not to drop it when removing it from the revolving nosepiece.

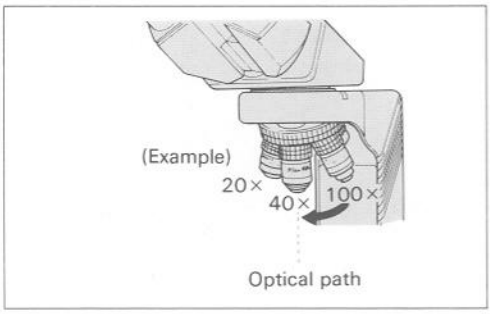


Fig.2-6

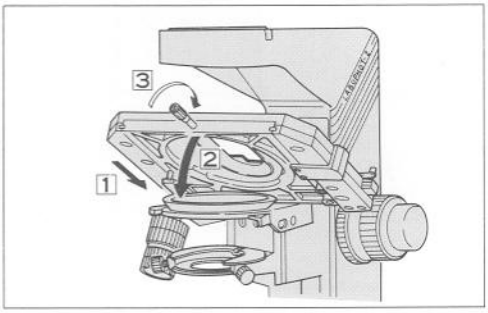


Fig.2-7

⑤ Mounting the Stage

- Lower the substage by turning the coarse focus knob.
- Loosen the stage clamp screw sufficiently.
- Insert the stage into the circular dovetail of the stage mount of the substage, [1] and [2]. Fasten the stage with the stage clamp screw [3] (Fig. 2-7).

Specimen Holder

- The specimen holder should be fastened to the mounting hole on the right side for a left-knob stage and on the left side for a right-knob stage. Remove the specimen holder when observing a large specimen.

⑥ Mounting and Dismantling the Condenser Lens

- Raise the substage by turning the coarse focus knob.
- Lower the condenser carrier to its limit by turning the condenser focus knob.
- Insert the condenser lens into the condenser carrier [1] with the numerical aperture plate facing toward the user. Fasten it with the condenser clamp screw [2] (Fig. 2-8).
- Raise the condenser carrier to its limit by turning the condenser focus knob.

Cautions when Dismantling

- Remove the ND filter cassette if attached.
- Lower the condenser carrier to its limit by turning the condenser focus knob. Remove the condenser lens by releasing the condenser clamp screw.

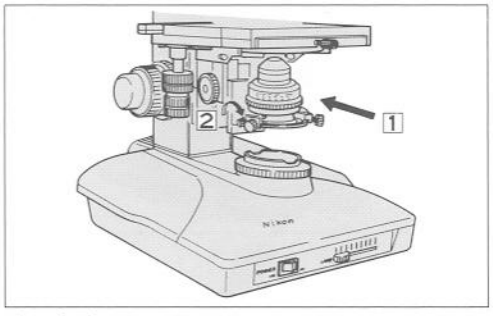


Fig. 2-8

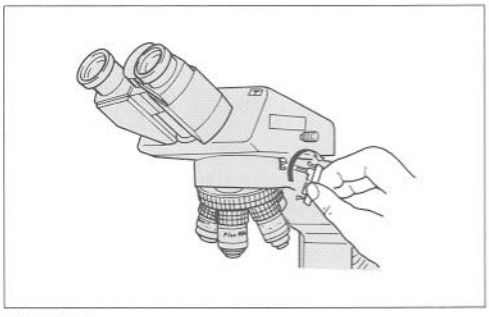


Fig. 2-9

⑦ Mounting the Binocular Eyepiece Tube

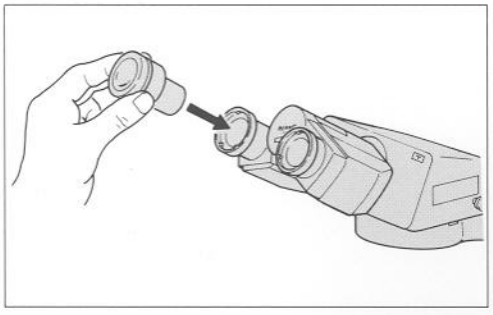
- Loosen the eyepiece tube clamp screw sufficiently using the hexagon wrench. (See ⑫.)
- Insert the circular dovetail of the trinocular eyepiece tube into the circular dovetail of the eyepiece tube mount. Fasten it with the eyepiece tube clamp screw (Fig. 2-9).

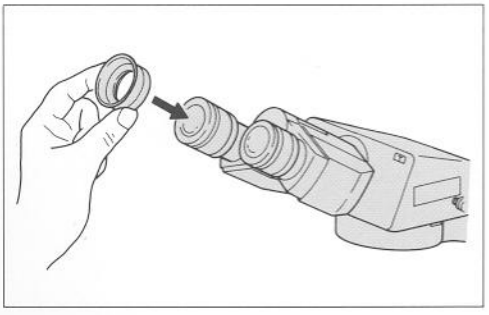
Caution when clamping

- Do not hold the plastic part of the hexagonal wrench when tightening the eyepiece tube clamp screw. Hold the stem of the wrench. If overtightened, optical-path change-over of the eyepiece tube may be malfunctioned.

⑧ Mounting the Eyepiece

- Use the same magnification eyepieces for both the right and left eyes.
- Insert the eyepieces into the sleeves of the binocular eyepiece tube by engaging the three grooves of the eyepiece with the three protrusions of the sleeve (Fig. 2-10).
- When using eyeguard rubbers, insert them into the eyepieces (Fig. 2-11).





⑨ Placing the Filter on the Filter Receptacle

Place the ϕ45mm filter on the filter receptacle of the field lens part.

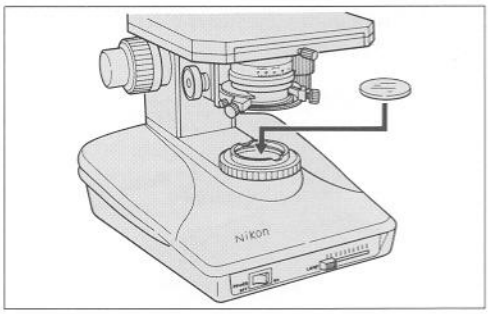


Fig. 2-12

⑩ Mounting and Dismantling the ND Filter Cassette (optional)

- Push down the ND filter cassette from the top so the two protrusions of the lower part of the ND filter cassette fit with the two mounting grooves on the rim of the field lens part of the microscope base (Fig.2-13).
- When frequently lowering the microscope stage, mount the ND filter cassette in the direction as shown in Fig. 2-14.
- When dismantling, push the cassette either to the left or right and raise the opposite side.

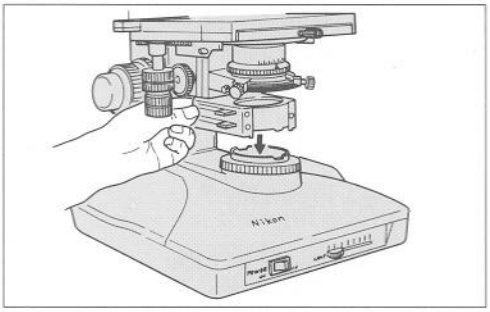


Fig. 2-13

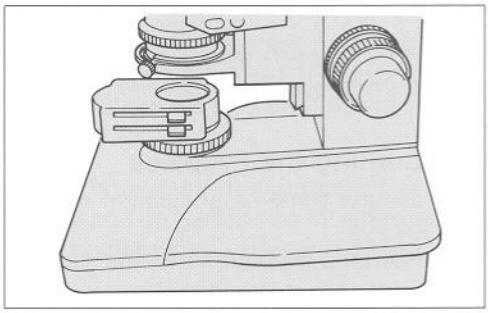


Fig. 2-14

⑪ Connecting the Power Cord

- Insert the socket of the power cord to the AC input connector and plug it into a AC line receptacle (Fig. 2-15).
- When the receptacle is not a double-pole ground type, use a plug converting adapter (Fig. 2-16).

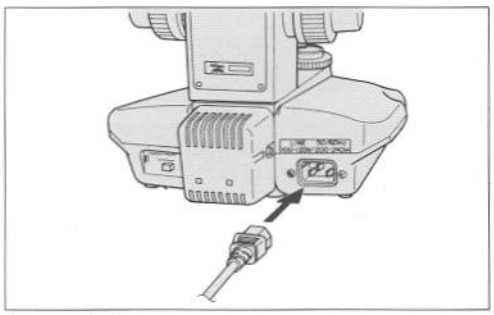


Fig. 2-15

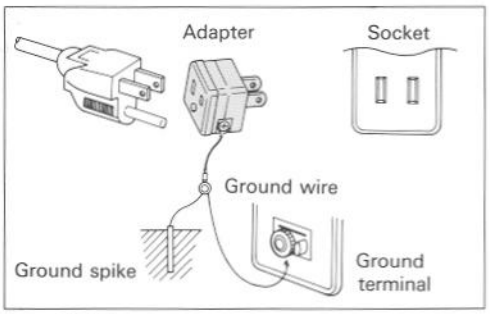


Fig. 2-16

⑫ Hexagon Wrench

- The hexagon wrench is stored in the back of the microscope stand. Take it out as shown in Fig. 2-17.

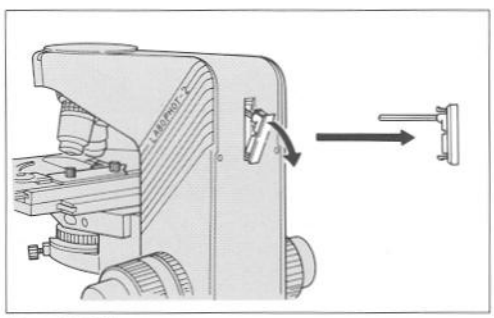


Fig. 2-17

III. MICROSCOPY

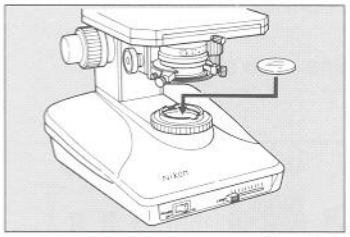


Fig.3-1

1) Put the NCB 11 filter (or necessary filter) on the filter receptacle of the field lens part (Fig. 3-1).

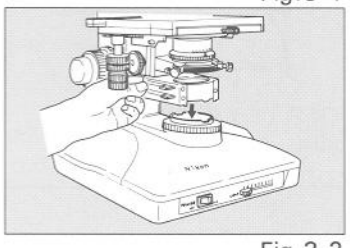


Fig.3-2

2) Mount the ND filter cassette, if used (Fig. 3-2). (Refer to II.ASSEMBLY-⑩ p.10)

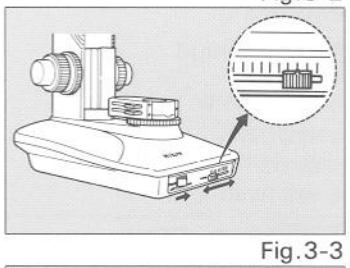


Fig.3-3

3) Turn on the main switch to light the lamp. Slide the brightness adjuster to meet with the 3rd line from the right. (Fig. 3-3).

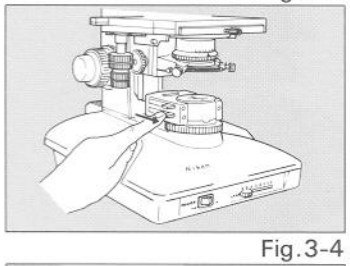


Fig.3-4

4) Slide the filter insertion/ removal knobs of the ND filter cassette to the limit to place the entire ND filter in the optical path (Fig. 3-4).

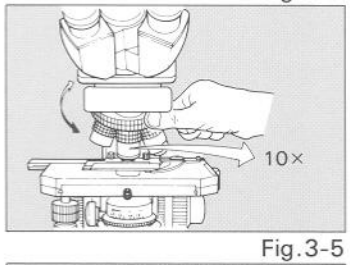


Fig.3-5

5) Revolve the revolving nosepiece to put the 10X objective into the optical path. Properly turn the revolving nosepiece so it fits into position (Fig. 3-5).

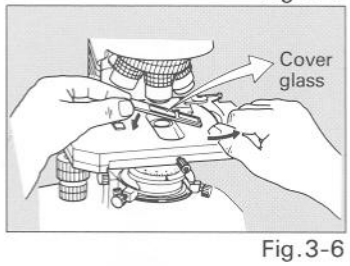


Fig.3-6

6) Place the specimen (glass slide) on the stage with its cover glass facing up and fasten it with the specimen holder (Fig. 3-6).

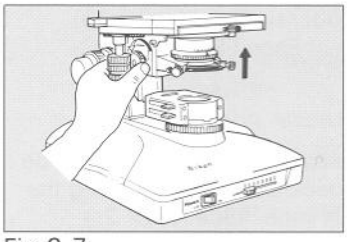


Fig.3-7

7) Raise the condenser lens using the condenser focus knob until it hits the limit (Fig. 3-7). When using an achromatic aplanat condenser, add oil taking care not to allow bubbles to exist between the top of the condenser lens and the specimen.
(See p. 23, Manipulation of Each Element-9).)

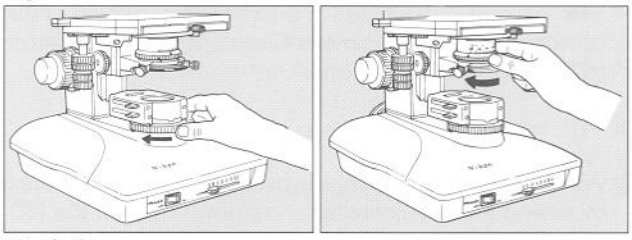


Fig.3-8

8) Fully open the field and aperture diaphragms (Fig. 3-8).

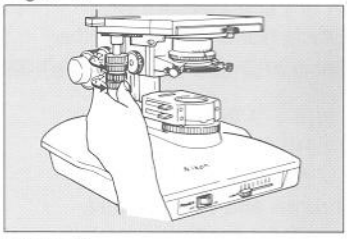


Fig.3-9

9) Manipulate the Y-axis and X-axis stage motion control knobs to put the specimen into the optical path (Fig. 3-9). (Place the specimen above the condenser lens.)

10)When the trinocular eyepiece tube is used, change the optical path of the eyepiece tube to enter 100% of the light into the binocular part.
(See p. 17, Manipulation of Each Element-2).)

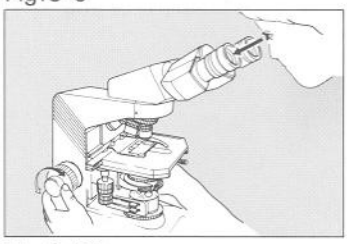


Fig.3-10

11) Manipulate the coarse/fine focus knob and focus on the specimen while looking in the eyepiece (Fig. 3-10).

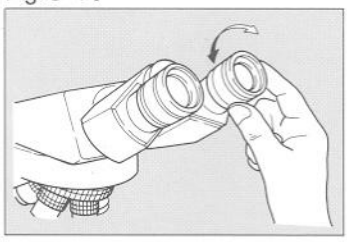


Fig.3-11

12) Adjust the diopter (Fig. 3-11).
(See p. 18, Manipulation of Each Element-3).)

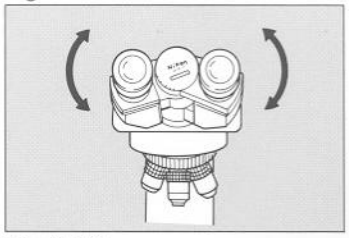


Fig.3-12

13) Adjust the interpupillary distance (Fig. 3-12).
(See p. 18, Manipulation of Each Element-4).)

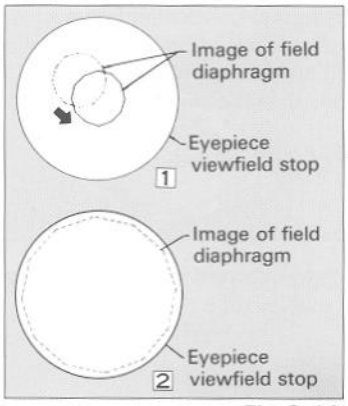


Fig.3-13

14) Focus and center the condenser lens (Fig. 3-13). (See p.19, Manipulation of Each Element-5).)

15) Revolve the revolving nosepiece to the objective to be used and focus on the specimen by manipulating the fine focus or coarse focus knob. (See Note: 2.) When using an oil immersion objective, add oil taking care not to allow bubbles to exist between the top of the objective and the specimen. (See p. 23, Manipulation of Each Element-9).)

16) When the ND filter cassette is used, Adjust the brightness by sliding the filter insertion / removal knob of the ND filter cassette. (See p. 21, Manipulation of Each Element-8).) When the ND filter cassette is not used, adjust the brightness of the lamp by manipulating the brightness adjuster.

17) Adjust the viewfield diaphragm and the aperture diaphragm by manipulating their control rings. (See p. 20, Manipulation of Each Element-6) and 7).)

Note 1: Manipulate the centering screws of the condenser lens if part of the viewfield is dark. If this doesn't help, check the following items:

• Insertion / removal of the ND filter cassette	Ⅲ. MICROSCOPY-4)
• Turning the revolving nosepiece(click-stop position)	Ⅲ. MICROSCOPY-5)
• Position of the condenser lens	Ⅲ. MICROSCOPY-7)
• Viewfield and aperture diaphragms fully open	Ⅲ. MICROSCOPY-8)
• Change-over of the optical path of the eyepiece tube	Ⅲ. MICROSCOPY-10)
• Mounting the lamp	Ⅱ. ASSEMBLY-③ Mounting the lamp and the lamp housing
• Mounting the condenser	Ⅱ. ASSEMBLY-⑥ Mounting the condenser
• Placing the filter on the filter receptacle	Ⅱ. ASSEMBLY-⑨ Placing the filter

Note2: Check the following items when the specimen cannot be focused.

• Mounting the specimen	Ⅲ. MICROSCOPY-6)
• Thickness of the cover glass(standard=0.17mm)	

Ⅳ. MANIPULATION OF EACH ELEMENT

1) Use of Focusing Device

The turning direction of the knob and the direction of vertical movement of the stage are shown in Fig. 4.
One rotation of the fine focus knob moves the stage 0.1mm and the graduation on the fine focus knob is 1 micron. One rotation of the coarse focus knob moves the stage 12mm. The range of coarse and fine motion is 2mm up and 28mm down from the standard position.
The coarse focus knob tightens by turning the torque adjustment ring counterclockwise.
Never turn the right or left knob while holding the other. It may cause problems.
Do not turn the coarse focus knob further than the limit.

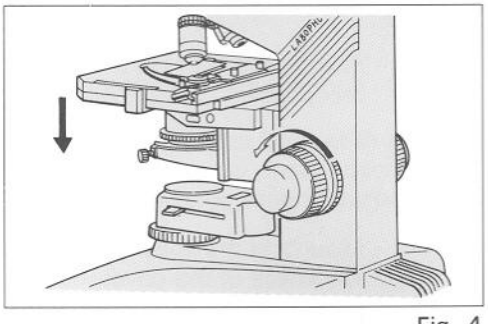


Fig. 4

2) Optical Path Change-Over in the Trinocular Eyepiece Tube

Note) Binocular eyepiece tube "B" does not have the optical path change -over function. 100% of the light enters the observation tube.

(1) When using the trinocular eyepiece tube "F"

As shown in Fig. 5-1, when the observation tube is turned toward the user, 100% of the light enters the observation tube.
As shown in Fig 5-2, when the observation tube is revolved 60° left, 100% of the light enters the vertical photo tube. In either case, turn the tube to the limit.

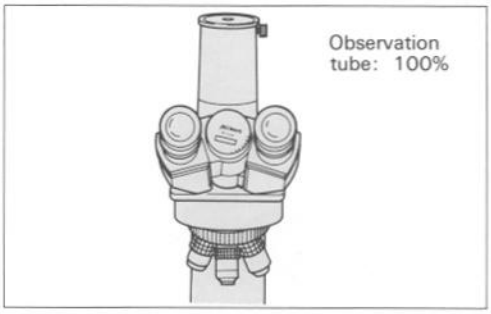


Fig. 5-1

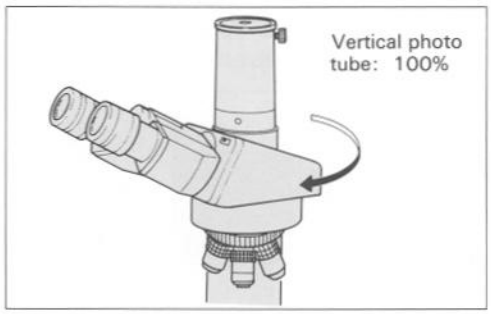


Fig. 5-2

(2) When using the trinocular eyepiece tube "T"

As shown in Fig. 6, when the change-over knob is pushed until it reaches the limit [1], 100% of the light enters the observation tube. When the change-over knob reaches the intermediate click [2], the proportion of light entering the observation tube and photo tube will be 14:86. When the change-over knob is pulled to the limit [3], 100% of the light enters the photo tube.

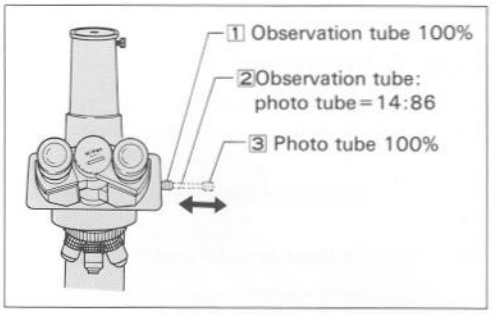


Fig. 6

3) Diopter Adjustment

(Before adjusting the diopter, implement MICROSCOPY procedures 1) to 11) and focus on the specimen with the 10X objective.)
Make diopter adjustments for both the right and left eyepieces.

(1) Turn the diopter compensation rings on each eyepiece until the end surface of the ring coincides with the engraved line. (This is the position of 0 dioptic compensation.) (Fig. 7-1)

(2) Swing the 40X objective by turning the revolving nosepiece and bring the specimen image into focus by turning the fine focus knob (or the coarse focus knob).

(3) Swing the 4X or 10X objective into position. Without **manipulating the fine and coarse focus knobs,** turn the diopter rings on the eyepieces so that the specimen images in the right and left eyepieces are focused individually (Fig. 7-2).

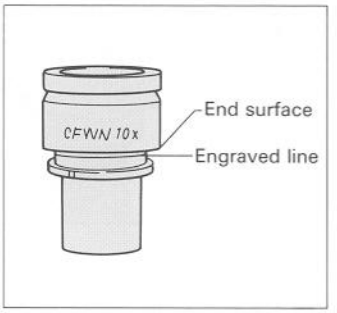


Fig.7-1

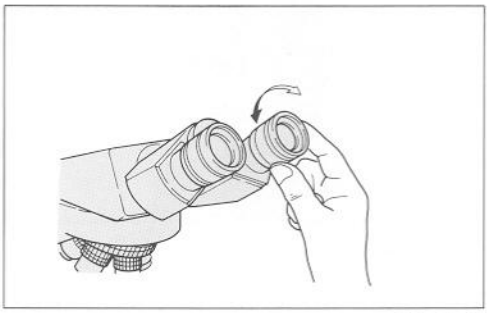


Fig.7-2

- Repeat the above procedure two times, to adjust the diopter perfectly.
- The above adjustment, compensating diopter difference between the user's right and left eyes, will keep the tube length of the microscope correct. This enables the user to take full advantage of the high-quality objectives, including their parfocality.

4) Interpupillary Distance Adjustment

(Before adjusting the interpupillary distance, implement Microscopy procedure 1) to 12) and focus on the specimen with the 10X objective.)
Adjust the interpupillary distance, so that both the right and left viewfields become one (Fig. 8).
This adjustment will enable the user to observe with both eyes.

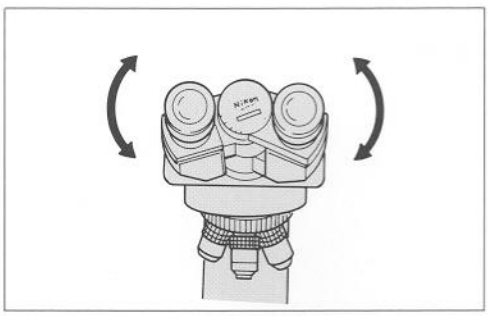


Fig.8

5) Centering the Condenser Lens

(Before focusing and centering the condenser lens, implement Microscopy procedure from 1) to 13) and focus on the specimen with the 10X objective.)

(1) Close the field diaphragm to its smallest size by manipulating the field diaphragm control ring. Rotate the condenser focus knob to move the condenser vertically so that a sharp image of the field diaphragm is formed on the specimen surface (Fig. 9-1,2 and 3).

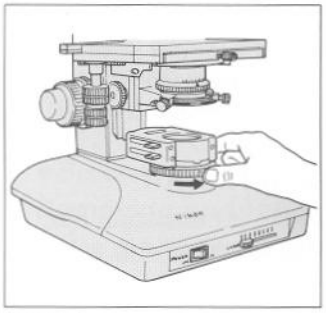


Fig.9-1

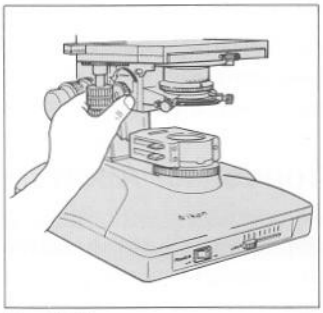


Fig.9-2

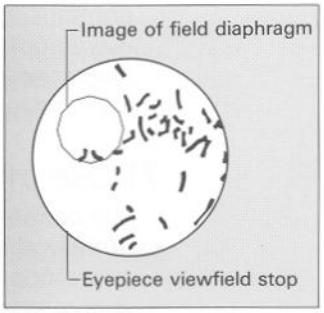


Fig. 9-3

(2) If the image decenters from the viewfield of the eyepiece, bring it roughly to the center of the viewfield by means of the condenser centering screws (Fig. 10-1 and 2).

(3) Change to the 40X objective. Focus on the specimen by turning the fine focus knob and form an image of the field diaphragm on the specimen surface by manipulating the condenser focus knob.

(4) When the image decenters from the viewfield of the eyepiece, bring it to the center of the viewfield by means of the condenser centering screws. At this time, the centering will be facilitated by adjusting the size of the image of the field diaphragm to be slightly smaller than the viewfield of the eyepiece by manipulating the viewfield diaphragm control ring (Fig. 10-3).

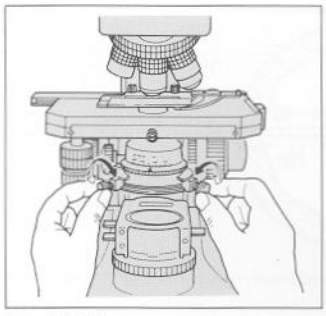


Fig.10-1

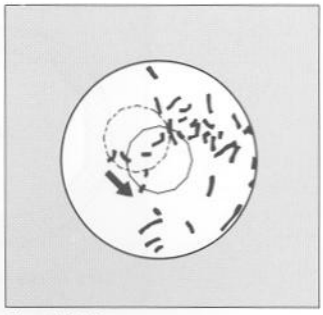


Fig.10-2

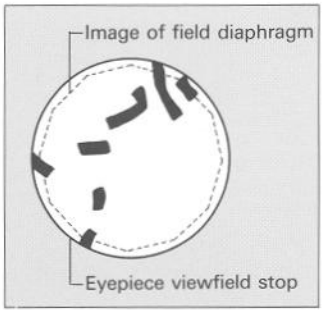


Fig. 10-3

6) Use of Field Diaphragm

The field diaphragm is used for determining the illuminated area on the specimen. The size of the diaphragm is adjusted by manipulating the field diaphragm control ring. Stopping down the diaphragm to such an extent that the circumference of the illuminated area circumscribes or inscribes that of the eyepiece field of view is recommended for general microscopy. If a wider area than required is illuminated, extraneous light will enter the field of view, causing flare in the image and lowering the contrast. Therefore, especially in photomicrography, the proper adjustment of the field diaphragm is very important. Generally, good results will be achieved when the diaphragm is stopped down to such an extent that the diameter of the illuminated area is slightly larger than the diagonal of the film format.

7) Use of Condenser Aperture Diaphragm

The condenser aperture diaphragm is provided for adjusting the numerical aperture (N.A.) of the illuminating system of the microscope. It is important because it determines the resolution of the image, contrast, depth of focus, and brightness.
Stopping down the aperture diaphragm will lower the resolution and brightness but increase the contrast and depth of focus. In general, when it is stopped down to 70% to 80% of the numerical aperture of the objective, a good image of appropriate contrast will be obtained (Fig. 11).
To adjust the size of the condenser aperture diaphragm, manipulate the diaphragm control ring referring to the condenser's N.A. scale, or after removing the eyepiece from the eyepiece tube, adjust the size of the diaphragm, observing the image of the diaphragm that is visible on the bright circle of the exit pupil on the inside of the objective.
Stopping down the aperture diaphragm too far will lower the resolving power. Therefore, it is recommended not to stop down the aperture to a size smaller than 60% of the N.A. of the objective in use, except when observing almost transparent specimens.

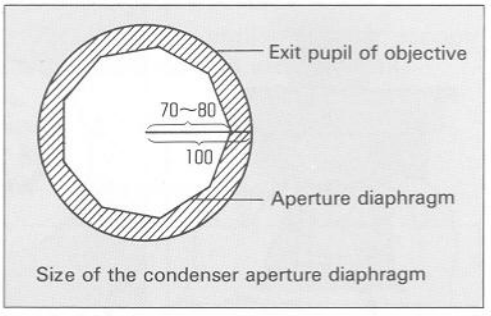


Fig. 11

8) Use of Filters

(1) ND filter cassette (Optional)

Accessory filters attached to the optional ND filter cassette are ND2, ND4, and ND16. These are used for general microscopy and brightness control in photomicrography.

ND2	Reduce light to 1/2	Transmission rate=about 50%
ND4	Reduce light to 1/4	Transmission rate=about 25%
ND16	Reduce light to 1/16	Transmission rate=about 6%

- Light is reduced to 1/8 when the ND2 and ND4 filters are put into the optical path and is reduced to 1/64 when ND4 and ND16 filters are put into the optical path. Light can be reduced from 1/2 to 1/128 depending on the combination of the filters.
- Securely change the filter insertion /removal knob.

Removing and mounting the ND filters

Use gloves or gauze so as not to touch the filters with your bare hands.

To remove the ND filter, lay soft cloth such as gauze on a desk. Place the ND filter cassette on it and spread the lever (Fig. 12).
To mount the filter, insert the filter obliquely in the opposite side of the lever and spread the lever from the lower side.
Any filters with an outer diameter of 45mm and thickness less than 3mm can be mounted in the ND filter cassette. The indication on the filter insertion ／ removal knob, however, can't be changed.

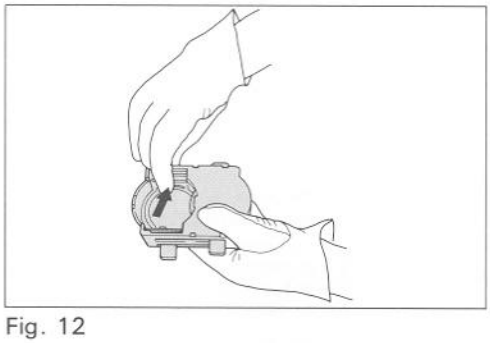


Fig. 12

Transparent Cover

Mount the transparent cover to protect the filters from dust (Fig. 13-1). When the ND filter cassette is removed, attach the transparent cover on the field lens (Fig. 13-2). However, remove the cover during observation or photomicrographing with the viewfield diaphragm stopped down.

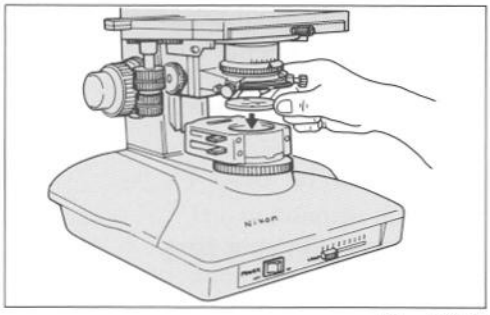


Fig. 13-1

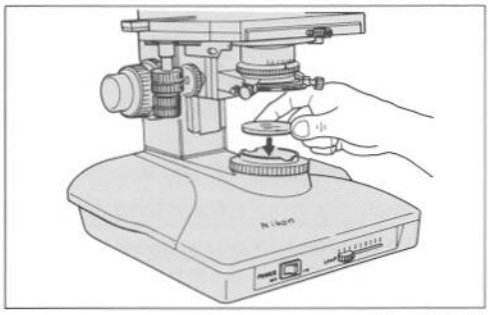


Fig. 13-2

(2) Filter receptacle

Filters with an outer diameter of 45mm can be placed on the filter receptacle of the field diaphragm part. If the thickness of the filter is less than 4.5mm, ND filter cassette can be mounted with the filter placed on the filter receptacle.

Therefore, less frequently changed filters such as shown in the table below are conveniently used placing them on the filter receptacle.

NCB 11	Color balancing filter	For general microscopy and color photomicrography
GIF	Green interference filter	For microscopy of phase difference, etc. For monochrome-photomicrography
HE	HE color contrast filter	For hematoxylin-eosin staining For fuchsine staining

(3) Other filters

- ϕ33mm Lemon skin filter
  When the optional achromat condenser is used, insert the ϕ33mm lemon skin filter into the receptacle between the collector lens and the lamp bulb. (Fig. 14-1)
- ϕ45mm heat absorbing filter
  When the heat absorbing filter is used, mount it into the diffuser holder inserted into the bottom of the microscope base.

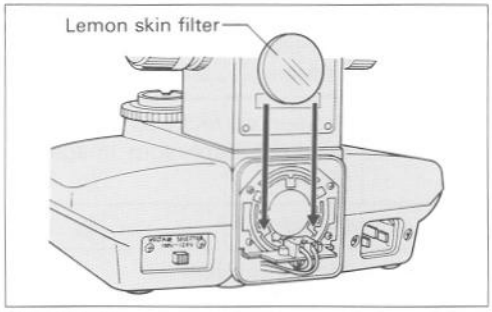


Fig. 14-1

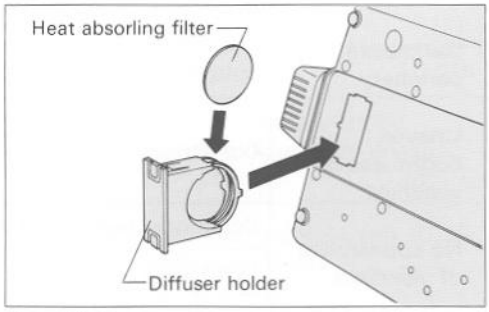


Fig. 14-2

9) Oil Immersion Manipulation

The objectives with the indication "oil" are to be immersed in oil between the specimen and the front lens of the objective. Use only the included oil. When using an oil immersion objective of numerical aperture 1.0 or larger, it is recommended to use an oil immersion type achromat/aplanat condenser to make full use of it's efficiency. For this type of condenser, apply oil between the specimen and the condenser lens.

Apply the minimum amount necessary (the quantity that fills the gap between the front of the objective and the specimen, or between the front of the condenser lens and the specimen) to avoid a flow of excessive oil that will adhere to the stage and the circumference of the condenser lens.

To see if air bubbles are present in the immersion oil, which deteriorate the image quality, pull out the eyepiece from the eyepiece tube. Fully open the viewfield diaphragm and the aperture diaphragm to examine the objective exit pupil (bright circle) inside the tube.

To remove air bubbles, slightly rotate the nosepiece several times (or turn the condenser focus knob to move it slightly up and down), or apply additional oil, or replace the oil.

Any remnant of oil left on the oil immersion objective or adhesion of oil to the front of the dry system objective will deteriorate the image quality. Clean off the oil after using it and make sure that the oil did not adhere to the front of other objectives.

The oil for the condenser lens should also be cleaned off after use. To clean off the oil, wipe with lens tissue or a soft cloth, moistened with xylene, lightly two or three times over the lens. It is essential at this time to avoid touching the lens with a part of tissue or cloth already used.

V. TROUBLESHOOTING

SEEING AND OPERATION

Failures	Causes	Actions
Darkness at the periphery. Uneven brightness of viewfield. No appearance of viewfield.	Optical path in trinocular tube not fully changed.	Changeover the optical path securely to binocular observation tube. (p. 17)
	Optical path in trinocular tube not changed-over for binocular observation.	
	Revolving nosepiece not in click-stop position (objective not centered in optical path).	Revolve it to click-stop position (put objective into optical path). (p. 12)
	Condenser is too low.	Position correctly so the viewfield diaphragm image is formed. (p. 19)
	Condenser not centered.	Centering. (p. 19)
	Condenser not mounted correctly.	Mount correctly. (p. 8)
	ND filter not fully changed-over.	Changeover to the limit. (p. 21)
	Field diaphragm closed too much.	Open properly. (p. 20)
	Improper combination of objective and condenser.	Use proper combination.
	Dirt or dust on the lens (field lens, condenser, objective, eyepiece, eyepiece tube entrance lens) or specimen.	Cleaning. (p. 2)
	Lamp not mounted correctly.	Mount properly. (p. 7)

Failures	Causes	Actions
Dirt or dust in the viewfield.	Position of condenser too low.	Position correctly so the viewfield diaphragm image is formed. (p. 19)
	Aperture diaphragm too restricted.	Open properly. (p. 20)
	Dirt or dust on the lens (field lens, condenser, objective, eyepiece, eyepiece tube entrance lens) or specimen.	Cleaning. (p. 2)
Poor image obtained (Contrast is too strong or too weak.) Details are not clear.)	Aperture diaphragm too restricted.	Open properly. (p. 20)
	Position of condenser too low.	Position correctly so the viewfield diaphragm image is formed. (p.19)
	Too thick or thin coverglass.	Use specified thickness (0.17 mm) coverglass.
	No coverglass attached.	
	NCG objective for observing specimen without coverglass used to observe specimen with coverglass.	Use normal objective for observing specimen with coverglass.
	Normal objective for observing specimen with coverglass used to observe specimen without coverglass.	Use NCG objective.
	No immersion oil used on the front of immersion system objective.	Use Nikon immersion oil. (p. 23)
	Immersion oil used not the type specified.	
	Air bubbles in immersion oil.	Remove bubbles. (p.23)
	Immersion oil soils the top of dry system objective (especially 40X).	Cleaning. (p. 23)
	Compensation ring of objective not adjusted.	Adjust to match coverglass.
	Dirt or dust on the lens (field lens, condenser, objective, eyepiece, eyepiece tube entrance lens) or specimen.	Cleaning. (p. 2)

Failures	Causes	Actions
One side of image is dim.	Revolving nosepiece not in click-stop position.	Revolve it to click-stop position. (p. 12)
	Specimen rises from stage surface.	Place it stably in specimen holder on stage. (p. 12)
	Stage tilted.	Attach correctly. (p.8)
Image moves while being focused.	Revolving nosepiece not in click-stop position.	Revolve it to click-stop position. (p. 12)
	Specimen rises from stage surface.	Place it stably in specimen holder on stage. (p. 12)
	Condenser lens not correctly centered.	Centering. (p. 19)
	Stage tilted.	Attach correctly. (p. 8)
Image tinged yellow.	NCB11 filter not used.	Use NCB11 filter. (p. 12)
	Lamp power source voltage too low.	Adjust the lamp voltage by manipulating the brightness adjuster. Use the optional ND filter cassette if the constant color temperature is to be desired.
Image too bright.	Lamp power source voltage too high.	
Not bright enough (see also Electrical).	Lamp power source voltage too low.	
	Aperture diaphragm too restricted.	Open properly. (p. 20)
	Position of condenser too low.	Position correctly so the viewfield diaphragm image is formed. (p. 19)
	Optical path change-over of trinocular tube not 100% binocular.	Changeover so that 100% of light enters binocular part. (p.17)

Failures	Causes	Actions
No focused image obtained with high power-objectives.	Slide upside-down.	Attach to stage with coverglass up (when no coverglass, specimen surface should be up). (p. 12)
	Coverglass too thick.	Use coverglass of specified thickness (0.17 mm).
High-power objective touches the specimen, when changed-over from low power.	Slide upside-down.	Attach to stage with coverglass up (when no coverglass, specimen surface should be up). (p. 12)
	Coverglass too thick.	Use coverglass of specified thickness (0.17 mm).
	Eyepiece diopter not adjusted.	Diopter adjustment. (p. 18)
Insufficient parfocality of objective when changed-over.	Eyepiece diopter not adjusted.	Diopter adjustment. (p. 18)
Movement of image not smooth when moving the specimen.	Slide holder not tightly fastened to stage.	Fasten it tightly.
Travel of stage limited to one-half length of slide.	Improper attachment of slide holder.	Shift the attachment position.
No cohesion of binocular image.	Interpupillary distance not adjusted.	Adjust interpupillary distance. (p. 18)
	Eyepiece diopter not adjusted.	Diopter adjustment. (p. 18)
	Magnifications of right and left eyepieces differ.	Use same eyepieces. (p. 9)
Experiencing eye fatigue.	Interpupillary distance not adjusted.	Adjust interpupillary distance. (p. 18)
	Eyepiece diopter not adjusted.	Diopter adjustment. (p.18)
	Inadequate illumination.	Adjust the lamp voltage by manipulating the brightness adjuster. Use the optional ND filter cassette and adjust the brightness with combination of ND filters. (p. 21)

ELECTRICAL

Failures	Causes	Actions
Lamp does not light even though switched ON.	No electricity obtained.	Connect the cord to socket.
	No bulb attached.	Attach lamp. (p. 7)
	Bulb blown.	Replacement. (p. 7)
	Fuse blown.	Replacement. (p. 6)
	Lamp not correctly mounted.	Attach securely. (p. 7)
Flickering and unstable illumination.	Bulb about to blow.	Replacement. (p. 7)
	Connector not secure.	Connect power source cord securely. (p.11)
	Fuse holder not firmly fastened.	Fasten securely. (p. 6)
	Bulb insufficiently inserted into the socket.	Positive connection. (p. 7)
Bulb immediately blown.	Bulb used not the one specified.	Use 6V 30W halogen lamp. (p.29)
Insufficient illumination.		
Fuse blown.	Input voltage change-over switch does not match the power voltage of the room.	Changeover input voltage change-over switch. (p. 6)
	Fuse used not the one specified.	Use the fuse specified. (p. 6)

ELECTRICAL SPECIFICATIONS

Power source ····· 100-120V/220-240V, 50/60Hz
Halogen lamp ····· 6V 30W [special type made by PHILIPS]
Fuse ····· 100-120V:250V 1A
220-240V:250V T1A
Power consumption ··· less than 43W

Nikon reserves the right to make such alterations in design as may be considered necessary in the light of experience. For this reason, particulars and illustrations in this handbook may not conform in every detail to models in current production.

NIKON CORPORATION

Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo 100, Japan
Tel: 81-3-3216-1026 **Telex:** J22601 (NIKON) **Fax:** 81-3-3201-5856

NIKON INC.

Instrument Group, Surveying Dept.

19601 Hamilton Avenue, Torrance, California 90502-1309, U.S.A.
Tel: (213) 516-7124 **Telex:** 967806 (NIKON GRCY) **Fax:** (213) 516-7751

NIKON EUROPE B.V.

Schipholweg 321, P.O. Box 222, 1170 AE Badhoevedorp, The Netherlands
Tel: 020-6594406 **Telex:** 13328 (NIKON NL) **Fax:** 020-6598335

Printed in Japan

M027 (91.5.E)H·E-4S